# The Real Shame of the Nation

## *The Causes and Consequences of Interstate Inequity in Public School Investments*

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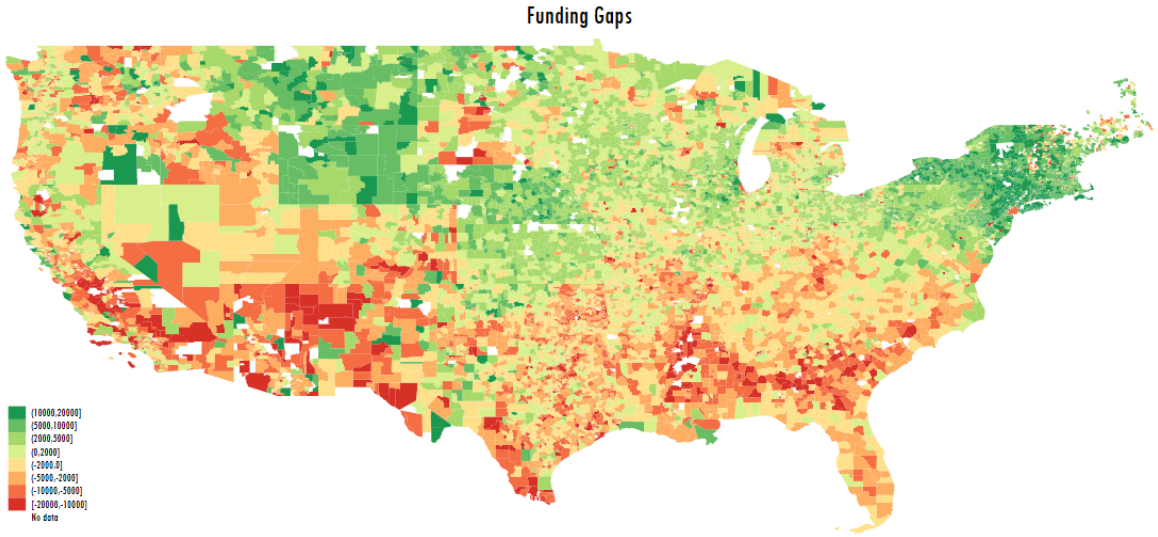


This report presents a first attempt at better understanding interstate variation in the costs associated with achieving common outcome goals across all settings and children. We take advantage of two recently released national data panels, applying methods used previously for inter-district, within state analyses of the costs of meeting common standards.

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## Executive Summary

For decades, school finance researchers have explored the impact of funding inequities across local public school districts *within* states on children's opportunities to meet state student achievement accountability standards. Due, however, to the variation of both state achievement tests and economic conditions within and between states, there has never been a national study comparing states' abilities to achieve a common student achievement outcome and assessing the cost associated for each state to do so. In addition, there has never been a study applying a uniform model for determining the fiscal impact of poverty on reaching a particular student achievement outcome across states.

This paper presents, for the first time, a new National Education Cost Model (NECM) to better understand the relative adequacy of state investments in public schooling toward achieving common outcome goals. The NECM builds upon two recently released national data panels, applying methods used previously for inter-district, within-state analyses of the costs of meeting common standards. The goal is to estimate and better understand between-state variations in the costs associated with achieving average student outcome goals across districts serving children of different poverty levels. Among the NECM's most notable findings:

- Most states fall below the funding levels necessary for their highest poverty children to achieve national average outcomes;
- High-poverty school districts in several states fall thousands to tens of thousands of dollars short, per pupil, of funding required to reach the relatively modest goal of current national average student performance outcomes on standardized assessments. In some states — notably Arizona, Mississippi, Alabama and California — the highest poverty school districts fall as much as $14,000 to $16,000 per pupil below necessary spending levels;

- In numerous states — including California, Arizona, New Mexico, Mississippi, Alabama, Georgia, and Tennessee — only the lowest-poverty districts have sufficient funding to achieve national average outcomes (but many low-poverty districts still do not have sufficient funding);
- Only a handful of states — including New Jersey and Massachusetts — are doing substantially better than others in terms of the average level of funding provided across districts in each poverty quintile and, consequently, the student achievement outcomes that flow from these more sufficient funding levels.

This paper reveals not only the significant variation in student achievement outcomes across U.S. states, but also the wide range of state and local investment in improving those outcomes. Put simply: there are striking differences in the investment in public schooling across states and a commensurate variance in the ability of states to achieve even modest student outcome levels. This paper further shows that states make vastly different levels of effort (i.e., spending relative to fiscal capacity) toward addressing their own fiscal and student outcome-related shortcomings. In addition, we show that some states lack the economic capacity to raise outcomes even to modest levels, even with relatively high effort.

The evidence of extreme variance in performance and capacity among state education systems presented in this paper raises significant policy implications. Most importantly, the evidence suggests that the oft-cited premise that our purported failure in educational outcomes (as measured by U.S. students' participation in international assessments) is a *national* failure, applying equally to all states, is inaccurate and misguided. So too is the popular notion that only certain U.S. schools and districts require much greater investments targeted at substantially raising the level of funding in those states and districts.

These extreme interstate variations in funding and student achievement outcomes require a new and enhanced federal role aimed at reducing interstate inequality in order to advance the national interest in improved outcomes across states. A new federal role in ameliorating school funding inequities would require Congress to pass legislation that targets federal education funds to resolve these disparities, with particular emphasis on (1) raising federal spending levels in states with large spending gaps and inadequate fiscal capacity to remedy those gaps, (2) encouraging low-effort, higher-capacity states with large school funding shortfalls and inequities to take appropriate steps to resolve those problems, and (3) restraining any federal disincentives on states that already exert significant effort toward providing their schools with adequate and equitable funding. In short, Congress must make reducing funding and outcome disparities within and between states (and regions) a priority, using federal funds to leverage state action that results in school funding reform.

## Table of Contents

## Introduction

Public education in the United States often comes under harsh criticism for failing to perform at the levels of other developed nations.[1] But unlike those nations, public education in the U.S. is provided through 51 distinct education systems (not including schools governed by U.S. territories, the Department of Defense, the Bureau of Indian Education, or Indian tribes), governed by 51 distinct state (including the District of Columbia) accountability and governance systems, and funded largely by state and local taxes. As Baker and Weber explain in a 2016 policy brief, several U.S. state education systems, such as Massachusetts and New Jersey, compare favorably to even the highest performing nations. This is because, on average, the children in those states are economically better off, their parents are better educated, and their schools are better funded.[2] In contrast, other states, such as Florida, perform much more poorly against international competition. Several U.S. states that have not reported separate outcomes on international assessments perform less well than Florida on the National Assessment of Educational Progress (NAEP), suggesting they would fare even worse in international comparisons.

State investments in elementary and secondary schooling vary widely, and many of the lower performing states are also among those spending the least on their schools.[3] But many of these same states have less economic capacity than other states to raise revenue for their schools.[4] States with smaller per capita economies are at an inherent disadvantage compared to states with larger economies: to generate comparable revenues, per capita, they must have higher tax rates. This presents a significant challenge to less affluent states that wish to impose tax rates comparable to more affluent states while also providing comparable public services.

To date, it has been difficult to determine just how much spending would be necessary to improve equity of student outcomes across states. Labor costs vary substantially across states, and the provision of public schooling remains labor-intensive (despite the claims that technological advances can reduce the number of staff and improve the efficiency of public schools, evidence suggests attempted innovations such as "virtual schools" have a poor track record of success[5]). Child poverty and other conditions affecting student outcomes also vary substantially across states.[6] These issues complicate empirical analyses that might help to determine just how much money is needed in New Mexico, for example, to achieve the same student outcomes achieved in Massachusetts. Further complicating matters, the U.S. does not use a common measure of student achievement outcomes across all public schools, districts, and states.[7] Rather, each state has developed its own system of measuring student outcomes, with some being far more rigorous than others. Moreover, existing national assessments such as the National Assessment of Educational Progress (NAEP) lack sufficient coverage of varied schools, districts, and student populations within all states to enable inter-district and interstate comparisons of outcomes.[8] If we wish to develop a more comprehensive picture of disparities not only across states but across all districts within states, we need standardized outcome measures across all districts in all states.[9]

For decades, school finance researchers have explored the impact of inequities across local public school districts *within* states on children's opportunities to meet state student achievement accountability standards. Such analyses usually rely on several years (5 or more) of annual data on student outcomes (across all districts), district expenditure data, and data on the characteristics of the student populations served and the settings in which they are served. The goal of these analyses has been to a) determine the per pupil costs of achieving state mandated student outcome goals across children, schools and districts in a state, and b) evaluate whether existing resources allocated to local public school districts are sufficient for meeting these goals.

In the past year, the release of two new national data panels of local public school district data has increased the feasibility of conducting such analyses nationally across all local public school districts in all states and the District of Columbia. First, the School Funding Fairness Data System, funded by the William T. Grant Foundation in collaboration with Rutgers University and the Education Law Center of New Jersey, has released a 22-year panel of district-level data on school expenditures; student population characteristics; and various district organizational, structural, and economic characteristics.[10] Second, the Stanford Education Data Archive has released nationally normed estimates of district-level state assessments of reading and math for the years 2009 to 2015.[11] In addition, Lori Taylor of Texas A&M, with colleagues, has developed a method for better equating poverty measurement from one region to another in the United States and across rural and urban settings within states.[12] Finally, Taylor has continued to produce an annual, district-level geographic competitive wage adjustment to aid in accounting for cost differences across regions and across local districts within states.[13]

In this report, we combine these new data sources to construct a *National Education Cost Model* (NECM) – the purpose of which is to determine the differences in costs associated with achieving national average student achievement outcomes across all school districts and states, and then to evaluate the extent to which districts and states are spending more or less than needed in order to achieve the relatively modest goal of achieving those outcomes.

A few caveats are in order:

1) We don't suggest that outcomes measured by test scores provide a holistic picture of the overall value of public education in those schools. We have not explored spending needed to achieve outcomes in subjects and areas beyond those measured in the state assessments relied upon in this paper: language arts (English) and mathematics.

2) We underscore that the cost model analyses presented here explore the relationship between spending and *average* student outcomes. Spending levels necessary to achieve higher than average (e.g., top 25%) outcomes, including in wealthier districts that may be spending above what is needed to achieve average outcomes, have not been explored or presented here. In other words: our analysis does not result in findings that show what funding might be necessary to "close the achievement gap." Rather, we attempt to

empirically determine what spending would be necessary for a district, given its student population characteristics and other factors, to achieve average outcomes.

We begin with a review of conceptions of school funding equity, adequacy, and equal educational opportunity. Next, we explain the basis for the econometric methods used herein for evaluating equal educational opportunity, equity and adequacy. Finally, using the NECM, we apply these methods to data on all school districts nationally from 2009 to 2015 to evaluate the state-by-state provision of equal educational opportunity.

### Conceptions of Equity, Adequacy & Equal Opportunity

As early as 1979, Robert Berne and Leanna Stiefel synthesized conceptual frameworks from public policy and finance and evidence drawn from early litigation challenging inequities in state school finance systems to propose a framework and series of measures for evaluating equity in state school finance systems.[14] This seminal work laid the foundation for subsequent conceptual and empirical developments regarding equity measurements applied to PK–12 settings.[15] Berne and Stiefel used two framing questions: 1) Equity of what? and 2) Equity for whom? On the "what" side, Berne and Stiefel suggested that equity could be framed in terms of financial inputs to schooling, real resource inputs such as teachers and their qualifications, and student outcomes. Berne and Stiefel's framework, however, predated a) judicial applications of outcome standards to evaluate school finance systems and b) the proliferation of state outcome standards, assessments, and accountability systems, first in the 1990s and then in the 2000s under the federal mandate of No Child Left Behind. The "who" side typically involved students and taxpayers—that is, a state school finance system should be based on fair treatment of both the citizens who fund public schools, and the students who attend them.

Drawing on literature from tax policy, Berne and Stiefel (1984) adopted a definition of "fairness" that provided for both "equal treatment of equals" (horizontal equity) and "unequal treatment of unequals" (vertical equity). That is, if two taxpayers are equally situated, their tax treatment (effective rate, burden, or effort) should be similar; likewise, if two students have similar needs, their access to educational programs and services or financial inputs should be similar. But if two taxpayers are differently situated (e.g., homeowner versus industrial property owner), then different taxation might be permissible. Similarly, if two students have substantively different educational needs requiring different programs and services, then different financial inputs might be needed to achieve equity.

While Berne and Stiefel provided a useful initial conception of school funding fairness, scholars of school finance eventually came to realize the limitations of horizontal and vertical equity delineations. First and foremost, horizontal equity itself does not preclude vertical equity. Equal treatment of equals does not preclude the need for differentiated treatment for some (non-equals). Further, vertical equity requires value judgments leading to categorical determinations as to just *who* is unequal, and just *how unequal* must their treatment be in order to be fair. That is,

vertical equity prompts questions such as: Who needs special or additional programs and services? How intensive and differentiated must those programs and services be? What outcomes would lead us to declare a program "fair"? Federal laws (adopted in the 1970s) continue to operate under this model, applying *bright line* (you're in or you're out) categorical declarations as to *who* is eligible for differentiated treatment and frequently requiring judicial intervention to determine *how much* differentiation is required for legal compliance.[16] To be clear, the focus on specific categories of disadvantaged children is important and remains necessary. But most children do not fall under the categories set forth under federal (or state) laws, such as disability status or English learner status, even though there are vast differences in needs among these uncategorized children. This ambiguity necessitates an alternative approach if education funding systems are to be reformed so as to meet the needs of all students and the goals of our society.

One such approach—one that would encompass all children and would unify existing approaches to achieve vertical equity in schools—posits that differentiated programs and services ought not be determined only by the inputs the child receives, but also by the outcomes that are expected of all children under state standards and accountability systems. That is, within the framework of *equal treatment of equals,* the treatment in question is the outcome expectation – which is equal for all children. The attainment of equal treatment thus requires the provision of appropriate programs and services to equalize their opportunity to achieve the common outcome expectation. The obligation of the state is to ensure that all children, regardless of their background and where they attend school, have *equal educational opportunity* to achieve those common outcome standards.[17]

Where appropriate programs and services are required to provide equal opportunity to achieve common outcomes (i.e. *equal treatment*), there exists a viable *equal protection* argument on behalf of the most disadvantaged children who are not presently explicitly classified under federal statutes. Equal protection requires that *similarly situated* individuals not be unequally deprived of rights. While no federal right to any level or quality of education presently exists, the right to equal protection under the 14th Amendment of the U.S. Constitution applies to unequal treatment and deprivation of rights under state (or local) laws. The "right" in this case is the right articulated by many state courts (relying on state, but not federal, constitutional language) that all children should be able to achieve common outcome goals.[18] Children from low-income families and impoverished communities often attend under-resourced schools resulting in disproportionate deprivation of this right – the right to at least have equal opportunity to achieve the outcomes in question.[19]

The late 1980s and early 1990s saw a shift in legal strategy regarding state school finance systems away from an emphasis on achieving equal revenues across settings (neutral of property wealth) and toward identifying some benchmark for minimum educational *adequacy*. Politically, some advocates for this approach viewed it infeasible for states to raise sufficient state aid to close the spending gap between the poorest and most affluent districts, because achieving fiscal parity

would likely require *leveling down* the amount of revenue spent on schools and the expected educational outcomes in affluent districts. Focus on a minimum adequacy bar for the poorest districts would alleviate this concern and potentially garner the political support of affluent communities who no longer had anything to lose.[20] Koski and Reich (2006) explain that this approach is problematic, in part, because minimum adequacy standards are difficult to define and because, when some are provided merely minimally adequate education but others are provided education that far exceeds minimum adequacy, the former remain at a disadvantage. Further, reliance on the minimum adequacy bar is detrimental because, by tolerating an adequacy gap, it potentially creates an even larger outcome gap. Education is, in fact, is a *positional good* for which individuals compete, based on their relative position, in order to gain access to higher education and economic prosperity.[21] Setting a minimal adequacy bar effectively acquiesces to this reality; it continues to allow for a wide range of outcomes, correlated with community wealth, just so long as that range never drops below a minimal threshold.[22]

Others have adopted a more progressive *adequacy* view that focuses on state standards and accountability systems, and holds legislators accountable for providing sufficient resources for all children to meet those standards. In this view, state constitution education articles – which, unlike the federal constitution, explicitly require the state to provide its citizens with an education – are used to enforce this mandate.[23] Under the more progressive view, equal opportunity and adequacy goals are combined (but remain separable). That is, the state must provide equal opportunity for all children to achieve adequate educational outcomes. Funding must be at a sufficient overall level, and resources, programs and services must be provided to ensure that children with varied needs and backgrounds have the additional supports they require to achieve the mandated outcomes.

It remains important, however, to be able to separate equal opportunity and adequacy objectives both for legal claims and for empirical analysis. The adequacy bar can be elusive.[24] Equal opportunity is applicable to *any* level of common outcome, adequate or not. State courts are not always willing to declare that adopted assessments and outcome standards measure the state's minimum constitutional obligation.[25] Some state courts may be unwilling to delve into deliberations over "adequacy" altogether, given the fiscal implications of intervening and concerns over separation of legislative and judicial powers. These courts may be more willing to address unequal opportunities to achieve outcomes, where remedies may be achieved by redistribution of existing resources. Along similar lines, the state's ability to support a specific level of adequacy may be subject to the economic fluctuations that impact the state's ability to collect revenues.[26] Importantly, at those times when revenues fall short of supporting high (or even average) outcome standards, equal opportunity should still be preserved. That is, equal opportunity can be achieved even when the adequacy standard is lower than, equal to, or higher than a level necessary to meet targeted outcomes.[27]

### Understanding Cost Variation

Providing equal educational opportunity requires that each child has opportunity to gain access to a given set of outcomes. It also requires a recognition that achieving those outcomes varies in cost from child to child, location to location, and setting to setting for a variety of reasons. It is critical to consider all factors that influence costs in an integrated manner; failing to account for these factors will lead to specious comparisons between states, school districts, and schools.

The *education cost function* is the most appropriate tool for understanding cost variation across diverse settings and student populations. Education cost function modeling has been used extensively in peer-reviewed studies of education costs and cost variation.[28] As Downes (2004) notes, "Given the econometric advances of the last decade, the cost-function approach is the most likely to give accurate estimates of the within-state variation in the spending needed to attain the state's chosen standard, if the data are available and of a high quality" (p. 9).[29] In particular, significant advances in data quality, statistical computing and econometric techniques since 2004 have improved education cost modeling.[30]

In this paper, we have – for the first time – applied education cost modeling to generate reasonable, empirically grounded estimates for the extent to which the costs of achieving current national average outcomes (by district type) vary from one school district to another, and from one state to another. Our model allows us to address the question: How much more or less does it cost to achieve national average outcomes in a district with high poverty levels than in more affluent (and predominantly white) middle-class communities? These estimates of cost variation can then be used to adjust or correct for cost differences in the value of current operating expenditures. Thus, education cost modeling – based on actual data on schools, outcomes, and student characteristics – is the most reasonable approach for determining and comparing the costs of educating students across school districts and states.

### The Purpose of Cost Model Estimates

The modeling of education spending generally takes two forms: a *cost perspective* or a *production perspective*.[31] At their most basic levels, each answers a different but related question:

- Cost perspective: Holding all else equal, including educational outcomes, how much does a school, school district, or state spend?

- Production perspective: Holding all else equal, including spending, what educational outcomes does a school, school district, or state achieve?

For our purposes here, the cost perspective is the more relevant one. We are interested in ascertaining the cost of achieving a certain level of educational outcomes, and how that cost changes as factors such as student characteristics, geographic region, and others change. We discuss this choice further in Appendix B.

The goal of education cost modeling, whether for evaluating equal educational opportunity or for producing adequacy cost estimates, is to establish reasonable guideposts for developing more rational state school finance systems. Historically, funding levels for state school finance systems have largely been determined by taking the total revenue generated for schooling as a function of statewide tastes for taxation and dividing that funding by the number of students in the system. In this limited approach, the budget constraint – or total available revenue – and total student enrollment have been the key determinants of the foundation level or basic allotment. To some degree, this will always be true: states and localities will always have some limit on the amount of revenues they can collect and distribute for public schools. But reasonable estimates of the "cost" of producing desired outcomes, given current technologies of production, may influence the appetite for additional taxes by revealing whether the preferences regarding taxation and the desired student outcomes in public education are misaligned, and that therefore one or the other should be adjusted.

By way of analogy: Let's say an individual asserts he wants to buy a Cadillac Escalade but wishes only to spend about $25,000. After a little research, he finds that he can either buy a Ford F-150 for $25,000 or an Escalade for $65,000. The buyer may then decide to go with the Ford, or increase his spending to enable the Escalade, or choose a different car in the middle. But he can only make an informed choice after determining the true costs of his options.

This is where the empirical research we present becomes useful – by identifying the gap between uninformed assumptions and reasonably informed ones, albeit with greater precision (i.e., actual car prices, in our example above). Reasonable estimates of cost may assist legislators in setting spending levels consistent with outcome demands and in setting outcome goals that are attainable at desired spending levels. Reasonable estimates of cost may also assist courts in determining whether current funding levels and distributions (or the minimum educational achievement goals, for that matter) are unreasonable, insufficient, or otherwise substantially misaligned with constitutional or other legal requirements.

### Limitations and Critiques of Cost Model Estimates

There are limits to cost model estimates. First, they provide guidance regarding the general levels of funding increases that would be required to produce measured outcomes at a certain level, assuming that districts are able to absorb the additional resources without efficiency loss – in other words, assuming that efficiency of outcome production remains constant. This is not always the case: districts may use additional revenues for all sorts of programs or services. This additional spending is "inefficient" only in the sense that it does not contribute to improving the educational outcomes we measure. That is not to say this spending does not help districts achieve other goals important to the community or society in general: spending on sports programs, for example, may be desirable, but do not necessarily increase statewide accountability test scores. Cost models, therefore, are limited by the outcome measures employed within them.

Moreover, cost model estimates are not well suited to measuring the impact of short-term measures. For example, they cannot predict student outcomes *next* year if we adopt a state school finance system based on them *this* year. Studies of school finance reform suggest that school finance reforms must be both substantive and sustained in order to be successful.[32] Moreover, the immediacy of outcome changes due to funding increases depends on what is being funded. If additional dollars to high-need districts are leveraged toward high-quality preschool programs and/or class size reductions in the early grades, we are unlikely to see changes to college readiness outcomes in the following year (or even in the following five years). Similarly, if the additional dollars are leveraged toward increasing salaries of teachers in the years of employment in which they are most effective, thereby allowing districts to recruit and retain more skilled teachers over time, we are also unlikely to see immediate returns in student test scores.

Some critics of education cost analysis in general, and cost function modeling in particular, assert that these practices accept inefficient school policies as a given and fail to take into account cost-saving policy changes. For example, they point to the fact that local public school districts (inefficiently, in their opinion) pay their personnel based on parameters not associated with improved student outcomes.[33] Therefore, the critics assert, it is useless to consider the current spending practices of school districts when trying to determine how much needs to be spent to achieve desired outcomes in the future. If instead, they argue, school districts paid teachers based on the test scores their students produce, and if school districts systematically dismissed ineffective teachers based on those test scores, then productivity would increase dramatically and spending would decline. Educational adequacy, they assert, could be achieved at much lower cost; therefore, estimating costs based on current conditions or practices is a meaningless endeavor.[34] [35]

The most significant problem with this logic is that there is no empirical evidence to support it. It is entirely speculative, based on the assertion that teacher workforce quality or effectiveness can be improved, with no increase to average wages, simply by firing the poorest performing (say, the bottom 5%) teachers each year and paying the rest based on the student test scores they – or, more accurately, their students – produce. To return to the car purchasing analogy above, this is like assuming that somewhere out there is a vehicle with all the features of the Escalade but the price of the F-150 – specifically, a version of the Escalade produced by a new, yet-to-be-discovered technology with materials not yet invented, that allow that vehicle to be sold at less than half its original price. This is, to put it bluntly, no more than wishful thinking. And so, while some may criticize cost modeling as being constrained by current realities, they fail to provide a sound, alternative basis for making a judicial determination regarding constitutionality of existing funding or for informing statewide mandates or legislation.[36] Whatever their limitations, cost model estimates, as well as the recommendations of professionals and expert panels, can still serve to provide useful, meaningful information to guide the formulation of more rational, equitable, and adequate state school finance systems.

## Applying the Education Cost Function

The dominant modeling approach in recent peer-reviewed literature for the district level education cost function is one in which:

a) the dependent measure is a measure of current operating expenditures per pupil;

b) student outcome measures are treated as "endogenous" and instrumented using measures of the competitive context within which local public school districts operate; and

c) attempts are made to control for inefficiencies in the spending measure by including measures of variations in fiscal capacity and local public monitoring.

This approach is largely the product of years of peer-reviewed cost function estimation by William Duncombe, John Yinger and colleagues of the Maxwell School at Syracuse University.[37] Here, we provide the rationale for this approach.

These issues are statistically complicated but necessary for teasing out the relationship between school district spending and measured student outcomes. Figure 1 provides an overview of the issues listed above. Our goal is to elicit from district spending data the "cost" of achieving specific outcome levels. We are setting up a model in which we predict spending levels from educational outcomes (narrowly measured as student achievement in Math and Language Arts), and other factors, rather than predicting outcomes from spending levels. As such, we must take statistical steps to correct for the fact that spending is influenced by outcomes, while, simultaneously, outcomes are also affected by spending (the circular/feedback loop relationship in the picture). More spending can lead to better student outcomes, as increased funding can be used to reduce class sizes, recruit better-qualified personnel, provide support services, and so on. However, higher outcomes in a community may drive increased spending, as homeowners desire to have their schools continue to be perceived as high-performing, thus keeping their property values relatively high. In this case, there is no clear causal direction: the two factors affect each other simultaneously. The relevant statistical approach to isolate the causal effect of outcomes on spending (distinct from the effect of spending on outcomes) is to use a two-stage model in which we use exogenous (outside the loop) measures of each district's competitive context to correct for endogeneity (inside the loop feedback) in the outcome measure. A more extensive, technical explanation is provided in Appendix A.

In general, the main (second stage) equation of the education cost function is one in which a measure of current operating expenditures is expressed as a function of the outcomes achieved at those expenditure levels, the students served by school districts, a measure of variation in competitive wages (Input Prices) for teachers, structural characteristics of the school district such as grade ranges served, the size of the school district (perhaps coupled with other location factors

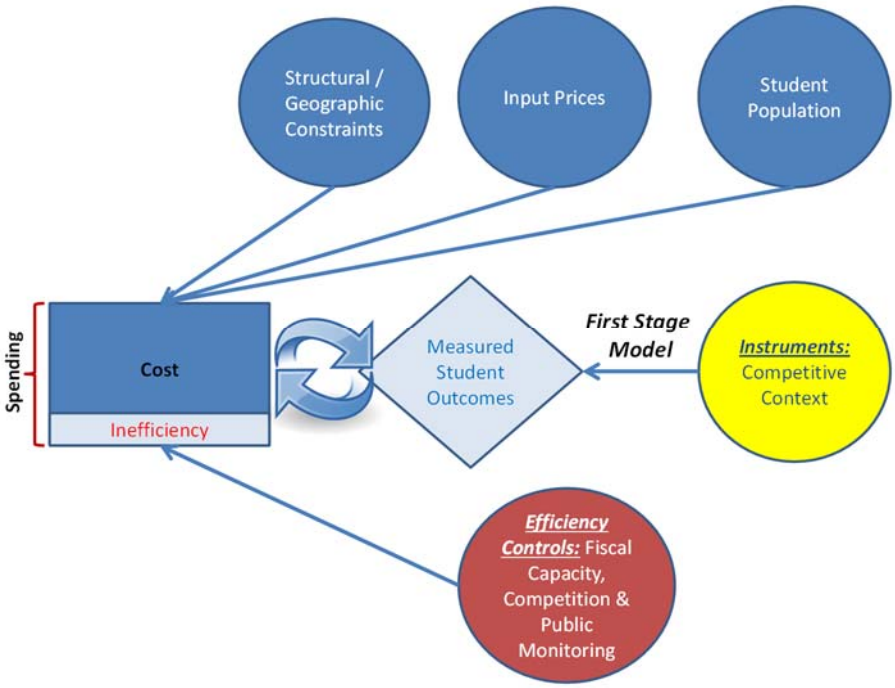
such as sparsity or remoteness), and any factors that might produce inefficiencies in the spending measure. The equation may be expressed as follows:

$$\textbf{Spending}_{dj} = f(\textbf{\textit{Outcomes}}_{dj}^{*}, \textbf{Students}_{dj}, \textbf{Input Prices}_{dj}, \textbf{Structure}_{dj}, \textbf{Scale}_{dj}, \textbf{Inefficiency}_{dj})$$

*endogenous

Where *Spending* is a measure of current per pupil operating expenses in district "d" in year "j"; *Outcomes* are the outcome measure(s) of interest; *Students* is a matrix of student need and demographic characteristics for district "d" in year "j"; *Input Prices* is a measure of geographic variation in the prices of key inputs to schooling such as teacher wages; *Structure* is a matrix of district structural characteristics such as grade ranges served; *Scale* is a measure of economies of scale usually expressed in terms of student enrollments and, in some cases, also addressing population sparsity; and *Inefficiency* is a matrix of variables which predict variation in spending but are not related to commensurate shifts in outcomes.

**Figure 1**




Another issue we must deal with is the fact that not all school district spending is efficient spending, or by statistical definition here, spending which contributes directly to the measured outcomes. In any given school district, some part of current spending contributes directly to the measured student outcomes used in the model, given the students served, salaries of teachers, and the structure, size, and location of the school district. The objective of the cost function is to identify the levels of spending associated with achieving specific outcome levels under different

circumstances and across varied student populations, holding factors associated with inefficiency constant.

In the modeling approach used here, we include measures which research literature identifies as predictors of differences in district spending not directly associated with outcomes (i.e., inefficiencies). These include measures of local district competition density and measures influencing local public monitoring of public expenditures (share of aid coming from non-local sources and proportions of local population that is school-aged). A more extensive discussion of controlling for efficiency is included in Appendix B.

### National Education Cost Model

Here, we provide a brief walkthrough of the application of our cost model with our combined national data sets, resulting in a panel of data on approximately 11,500 local education agencies from 2009 to 2015. The dependent measure in the model is the Census Fiscal Survey current operating expenditure per pupil (PPCSTOT). Our educational outcome measure is an average across subjects and grade levels of the NAEP equivalent, nationally normed state assessments from the Stanford Education Data Archive. Reardon and colleagues compiled a national data set of student level state assessment data across all schools and districts within states from 2009 to 2015. Using NAEP scores on sampled schools within states, the authors are able to determine the NAEP scale score associated with state assessment scores for select schools and districts, and estimate NAEP scale score equivalents for all districts.[38] In our models, we estimate a diminishing returns relationship between spending and outcomes, taking the natural log of both the spending and outcome measures. This diminishing relationship is caused by several factors, including: 1) extremely underfunded districts may see larger gains in student outcomes from increased spending compared to adequately funded districts, and 2) outcomes measures have "ceilings" that cannot capture the effects of improvements in schooling at the upper end of the distribution of outcomes.

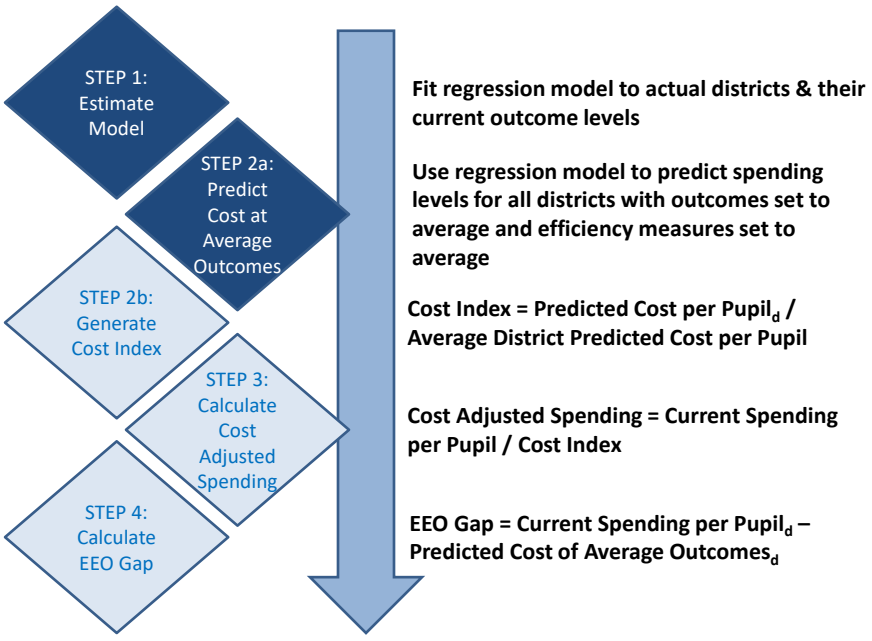
As stated above, there is an endogenous "feedback loop" relationship between spending and educational outcomes. While increases in spending will lead to improvements in outcomes, better outcomes will simultaneously lead to increases in spending. Our outcome measure, therefore, is instrumented with two exogenous measures of the competitive context in which each school district operates – the median household income and the median housing values of all neighboring districts sharing the same labor market.[39] Our efficiency measures – or factors that predict spending variation that is unrelated to, or in addition to, outcomes – include a measure of market competition density (Herfindahl index), and a measure of the extent to which districts depend on revenue from sources other than local taxes, presumed to reduce local public monitoring (thus reducing pressure to spend efficiently).

We use an adjusted poverty measure to capture broadly variations in student needs that affect the cost of achieving common outcome goals. We interact the poverty measure with

population density based on prior cost modeling research that indicates that poverty-related costs escalate with population density.[40]

Fitting the cost model to our national data set is only the first step in the process. The model merely characterizes the existing relationships between spending and outcomes, given the other model factors, across districts. We can now use this model to predict costs of common outcomes and generate cost indices which represent the differences in costs across districts for achieving common outcomes. Figure 2 presents the flow of the applications of our cost model herein, beginning with fitting the cost model, then using that model to generate cost predictions for all districts. These cost predictions can be used to generate an index of how much more or less it costs in one district, state or region than another to achieve the common outcome goal – national average outcomes. We can use the cost indices to calculate cost adjusted values of existing spending – that is, how much is current spending worth toward achieving common outcomes in one district, state or region compared to another? Finally, because our model predicts the spending necessary to achieve national average outcomes, we can compare directly each district's actual current spending with the predicted necessary spending, thus calculating an Equal Educational Opportunity (EEO) Gap for each district. Elaboration on these steps follows.

**Figure 2**



Step 1 – Estimate the Model

Table 1 provides our cost model estimates. To summarize, our cost model estimates reveal that:

- It costs more to achieve higher outcomes than to achieve lower outcomes;
- It costs more to achieve common outcomes in higher-poverty than in lower-poverty settings; in addition, costs associated with poverty rise as population density rises;
- It costs more to achieve average outcomes where labor costs are higher;
- As total district enrollments decrease, it costs more per pupil to achieve average outcomes;
- As population density increases, costs of achieving average outcomes per pupil tend to decline;
- Between 2009 and 2015, it appears that, all else being equal (controlling for all the other factors here), the costs associated with achieving average outcome goals declined slightly.

Regarding efficiency measures, we find that, where more competition density exists in a given labor market, districts tend to spend less toward achieving common outcomes (i.e., they are more efficient). But districts that are more dependent on intergovernmental transfers of aid tend to spend more toward achieving common outcomes (i.e., they are less efficient). This latter finding might be due to reduced "public monitoring" but also due to regulatory constraints placed on the expenditure of intergovernmental aid that reduce efficiency.[41]

**Table 1**
Instrumental Variables (Main Model) Regression of Education Spending (2009-2015)

| DV = Current Spending per Pupil | **Instrumental Variables Estimates[5]** | |
|---|---|---|
| | **coef** | **se** |
| Combined Grades 3-8 Reading & Math Outcome Index (ln)[1] | 11.058*** | 1.684 |
| *Student Demographics* | | |
| Adjusted Census Poverty Rate[2] | 3.414*** | 0.450 |
| Adj. Census Poverty Rate x Population Density | 0.112** | 0.046 |
| Education Comparable Wage Index[3] | 0.799*** | 0.065 |
| *Grade Range Enrollment Distribution* | | |
| % in pre-Kindergarten | -0.264 | 0.166 |
| % in Kindergarten | 0.160 | 0.311 |
| % in Grades 1 to 5 (baseline) | | |
| % in Grades 6 to 8 | -2.516*** | 0.331 |
| % in Grades 9 to 12 | -0.667*** | 0.154 |
| *Economies* of Scale (District Enrollment) | | |
| <100 | 0.209 | 0.367 |
| 101 to 300 | 0.312*** | 0.063 |
| 301 to 600 | 0.273*** | 0.044 |
| 601 to 1,200 | 0.163*** | 0.039 |
| 1,201 to 1,500 | 0.119** | 0.049 |
| 1,500 to 2,000 | 0.147*** | 0.054 |
| >2,000 (baseline) | | |
| Population Density | -0.064*** | 0.018 |
| <100 x Population Density | 0.057 | 0.089 |
| 101 to 300 x Population Density | -0.005 | 0.014 |
| 301 to 600 x Population Density | -0.016* | 0.009 |
| 601 to 1,200 x Population Density | -0.011 | 0.007 |
| 1,201 to 1,500 x Population Density | -0.010 | 0.009 |
| 1,500 to 2,000 x Population Density | -0.016 | 0.010 |
| Unified K-12 School District (Yes = 1) | 0.103*** | 0.031 |
| *Efficiency* Factors | | |
| State & Federal Aid % of Revenue (Public Monitoring) | 0.175** | 0.075 |
| Herfindahl Index[4] (Competition) | -0.112*** | 0.037 |
| % Population 5 to 17 yrs Old (Public Monitoring) | -0.247* | 0.138 |
| *Year (2009 = Baseline)* | | |
| year==2010 | -0.075*** | 0.014 |
| year==2011 | -0.130*** | 0.021 |
| year==2012 | -0.149*** | 0.023 |
| year==2013 | -0.168*** | 0.026 |
| year==2014 | -0.081*** | 0.016 |
| year==2015 | -0.084*** | 0.016 |
| Constant | -52.636*** | 9.388 |
| Number of observations | 80,670 | |

note: *** p<0.01, ** p<0.05, * p<0.1

[1] Nationally referenced (NAEP equivalents) state math and reading outcomes averaged across grade levels (natural log). Data source: https://stacks.stanford.edu/file/druid:db586ns4974/district%20means%20national-referenced%20by%20year%20grade%20subject%20(long%20file)_v1_1.dta

[2] Using Poverty Adjustment Factor x Census Poverty, based on: Baker, B. D., Taylor, L., Levin, J., Chambers, J., & Blankenship, C. (2013). Adjusted Poverty Measures and the Distribution of Title I Aid: Does Title I Really Make the Rich States Richer?. *Education*, *8*(3), 394-417.

[3] from: http://bush.tamu.edu/research/faculty/taylor_CWI/

[4] Herfindahl Index: Commonly used measure of market concentration, indicating competition. Estimated in Stata v. 14 (via hhi5 module: http://fmwww.bc.edu/RePEc/bocode/h/hhi5.hlp) using labor market (as per Taylor ECWI) as regional market and district enrollment shares among districts sharing each labor market.

[5] Diagnostic Notes:

Partial F = 27.83 (p<.01) Excluded instruments Census 2000 ln of MHI & MHU of all other districts in labor market (weighted by enrollment)

Hansen J (test for over-identification) = 0.002 (p-value=0.9612)

Step 2a – Predict Cost of Average Outcomes at Average Efficiency

The next step in the process is to use the cost model estimates from Table 1 to generate predicted values of the cost of achieving some common level of outcomes, holding efficiency factors constant. A common choice for outcome level when focusing on "equal educational opportunity" is the existing average outcome level. That is, we estimate the spending, at average efficiency, of achieving existing average outcome levels for every school district. For our purposes herein, to provide more stable and reliable estimates we then collapse these cost estimates to their most recent three year average (2013 – 2015) for each district.

Step 2b – Generate Comprehensive Cost Index

Another useful value which can be derived from cost function analysis is an overall "cost index" for each local public school district. Once we have an estimate of the "cost" – predicted expenditure associated with average outcomes, at average efficiency – for each local public school district, we can generate an overall cost index for each local public school district where an index value of 1.0 indicates a district with national average costs of achieving national average outcomes. We construct the index by taking each district's cost estimate and dividing that cost estimate by the average district cost estimate.

**Cost Index = Predicted Cost per Pupil$_d$ / Average District Predicted Cost per Pupil**

A cost index of 2.0, for example, would indicate a district whose predicted cost of achieving average outcomes would be twice as much as the average district. A cost index of 0.5 indicates a district whose predicted cost is half the average.

Step 3 – Calculate Cost Adjusted Spending per Pupil

The cost index can be used to calculate the cost adjusted value of each district's current spending levels. We often refer to this value as the "equal educational opportunity"-adjusted spending, or EEO-adjusted spending level. In other words: what is the value of each district's current spending toward achieving average outcomes? For example, one district might spend $10,000 per pupil and have relatively high costs and needs to achieve average outcomes, with an index of 1.5. The EEO-adjusted spending for that district is therefore:

**$10,000/1.5 = $6,667**

Another district might have exactly the same nominal spending per pupil of $10,000, but serve a relatively low-need population in a relatively low-cost area, with a cost index of 0.75. The EEO-adjusted spending for that district is therefore:

**$10,000/0.75= $13,333**

In other words, while the nominal spending per pupil for both districts is the same, the EEO-adjusted spending of the second district is twice that of the first. This approach permits more accurate evaluation of school funding equity across diverse settings and student populations.

Step 4 – Estimate Equal Opportunity Spending Gap

A final useful indicator for evaluating equity across districts, given our cost model results, is to compute the equal educational opportunity spending gap. This gap is simply the gap between each district's actual, nominal current spending per pupil and the predicted spending per pupil for that district to achieve national average outcomes:

$$\textbf{EEO Gap} = \textbf{Current Spending per Pupil}_d - \textbf{Predicted Cost of Average Outcomes}_d$$

The EEO Gap essentially tells us how much more the model predicts the district must spend to achieve average outcomes.

## Interpreting the Results

The following four graphs illustrate a handful of these indices a) for all districts nationally, b) for districts in the high spending, high performing state of New Jersey and c) for districts in the low spending and low performing state of Mississippi. Figure 3 shows the current spending per pupil for New Jersey districts as blue diamonds, for Mississippi districts as orange triangles, and for all other districts as green dots, with respect to our adjusted poverty measure. Districts are collapsed into poverty quintiles within each state. What we can see here is that, on average, Mississippi districts comprise student populations with poverty levels ranging from about 10% to over 40%, but that spending per pupil is low and doesn't vary much with respect to poverty. For New Jersey districts, many have very low student poverty levels, and some of these have relatively high spending. For districts with student poverty levels ranging from 10% to 40%, per pupil spending on average seems to rise, due to the state's relatively progressive approach to school funding.

## Figure 3

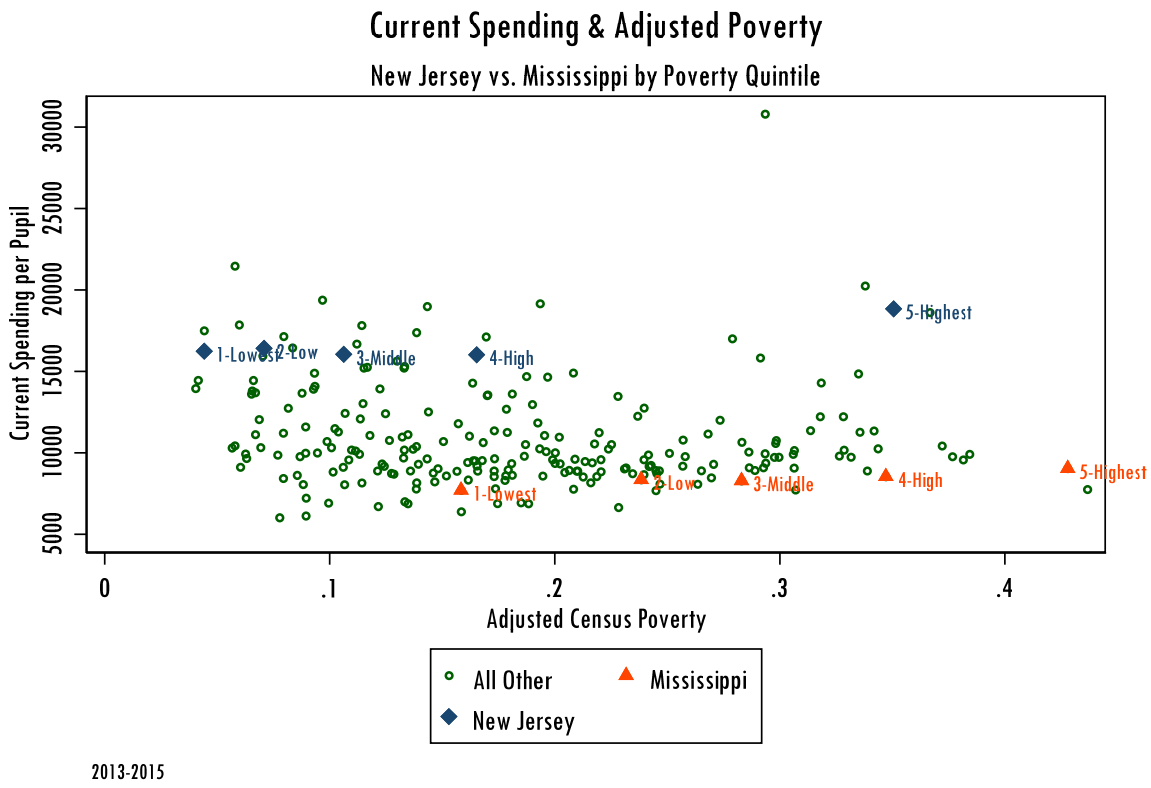



Figure 4 displays the predicted costs per pupil for achieving national average outcomes, again for New Jersey, Mississippi, and all other districts. Districts are collapsed into poverty quintiles within each state.

Costs of achieving national average outcomes rise sharply with our adjusted census poverty measure. It costs more than three times the amount per pupil ($20k to $30k) to achieve national average outcome goals in very high poverty districts (>40% poverty) as it does in relatively low poverty districts (<10% poverty) ($5k to $10k). Notably, though, along this trajectory, Mississippi per pupil costs run along the lower boundary – that is, it has lower per pupil costs to achieve average outcomes no matter what the poverty rate. This is likely due to both lack of population density and relatively low labor costs. High poverty districts in New Jersey, by contrast, have higher per pupil costs to achieve national average outcomes (>$30k for NJ compared to just over $20k in MS) due to the combination of high population density and high labor costs. That is, while poverty is a substantial determinant of the costs of achieving common outcomes, other factors related to labor markets and geography also matter.

## Figure 4

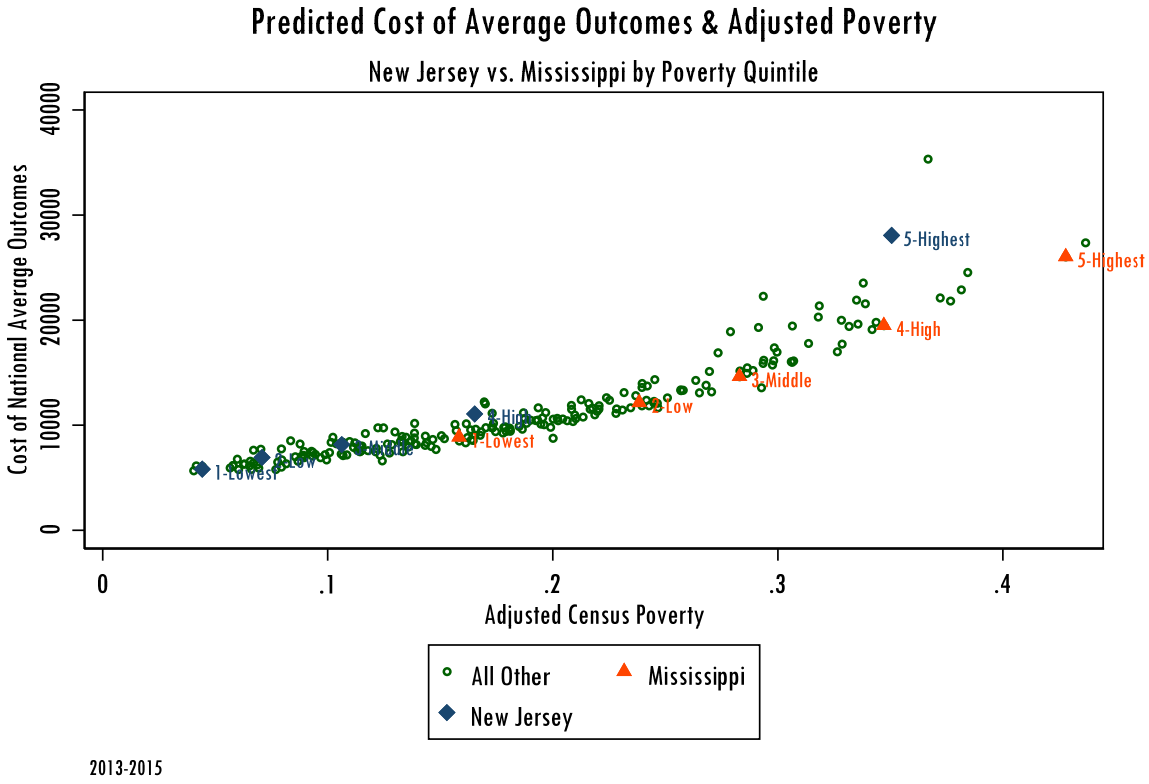



Figure 5 shows the relationship between our Equal Opportunity Funding Gap measure and a similarly constructed outcome gap measure, again illustrating the position of New Jersey, Mississippi, and all other districts. Notably, districts with higher current spending per pupil than needed to achieve average outcomes tend also to have higher than average outcomes. Districts with lower spending per pupil than needed to achieve average outcomes tend to have lower than average outcomes. Thus, spending gaps between districts are associated with outcome gaps between districts holding all other factors, such as student poverty, equal. However, both gaps are also heavily influenced by the prevalence of poverty among students in those districts.

While the general pattern described above is relatively clear, it is not perfect. As Figure 5 shows, there are groups (quintiles within states) of districts with spending above the predicted cost of average outcomes but with outcomes below average, and vice versa. While the correlation between spending and outcomes is clear, the pattern is fuzzy. These variations can occur, and would be expected to occur for a variety of reasons.

- First, our model may not be capturing every important differentiating feature of school districts affecting their costs of achieving national average outcomes;

- Second, data can be imperfect and imprecise, and often outliers in these representations include districts for which either the outcome data, spending data, or other characteristics are imprecise or inaccurately reported;
- Finally, even if our data were less imperfect and model fully specified, we would expect some variation in district efficiency. This variation may be driven by "true" inefficiency – spending intended to improve outcomes in tested subjects that, in fact, does not – or may represent spending on educationally sound programs that do not directly affect outcomes on state tests (extracurricular programs, instruction in untested subjects, etc.).
- We have predicted costs assuming "average efficiency," but all districts do not operate at average efficiency – some will spend more than expected, and others less to achieve target outcomes.

**Figure 5**

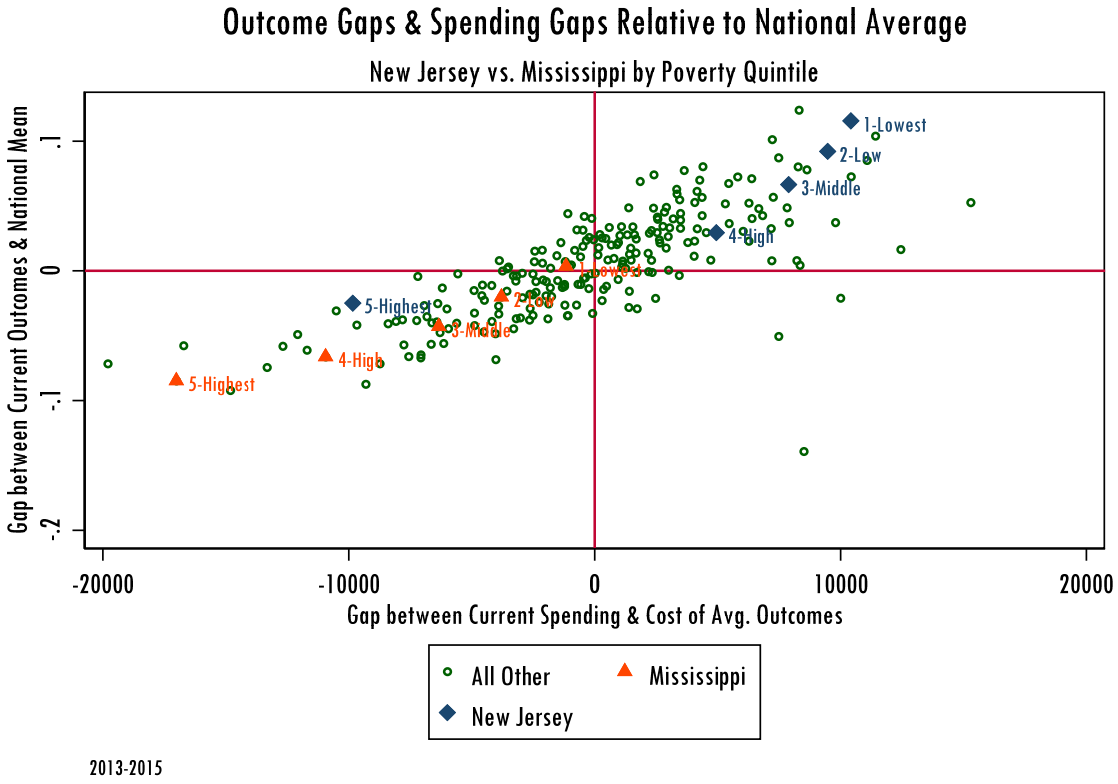



Figure 5 shows that four out of five New Jersey quintiles of districts spend more than necessary to achieve national average outcomes, and most do indeed achieve more than national average outcomes. In contrast, most Mississippi districts spend less than necessary to achieve national average outcomes and, indeed, most achieve less than average national outcomes. While New Jersey's highest poverty districts are predicted to have very large funding gaps with respect to what's needed to achieve average outcomes, those districts are already relatively close to

average outcomes. This could either mean that these districts are relatively efficient in the production of outcomes or that our model is overstating costs at the intersection of high poverty and very high population density. We expect the latter and continue to test alternative model specifications.

Figure 6 displays a national map of spending gaps (averaged for 2013-2015[42]). Districts in states in the Northeast from New Jersey to Massachusetts generally show up as having more than necessary funding to achieve national average outcomes. By contrast, states in the Southeast and Southwest show up as having far less than needed to achieve national average outcomes, with districts along the Mississippi River in Mississippi and throughout much of Arizona having far less than necessary to achieve national average outcomes.

**Figure 6**

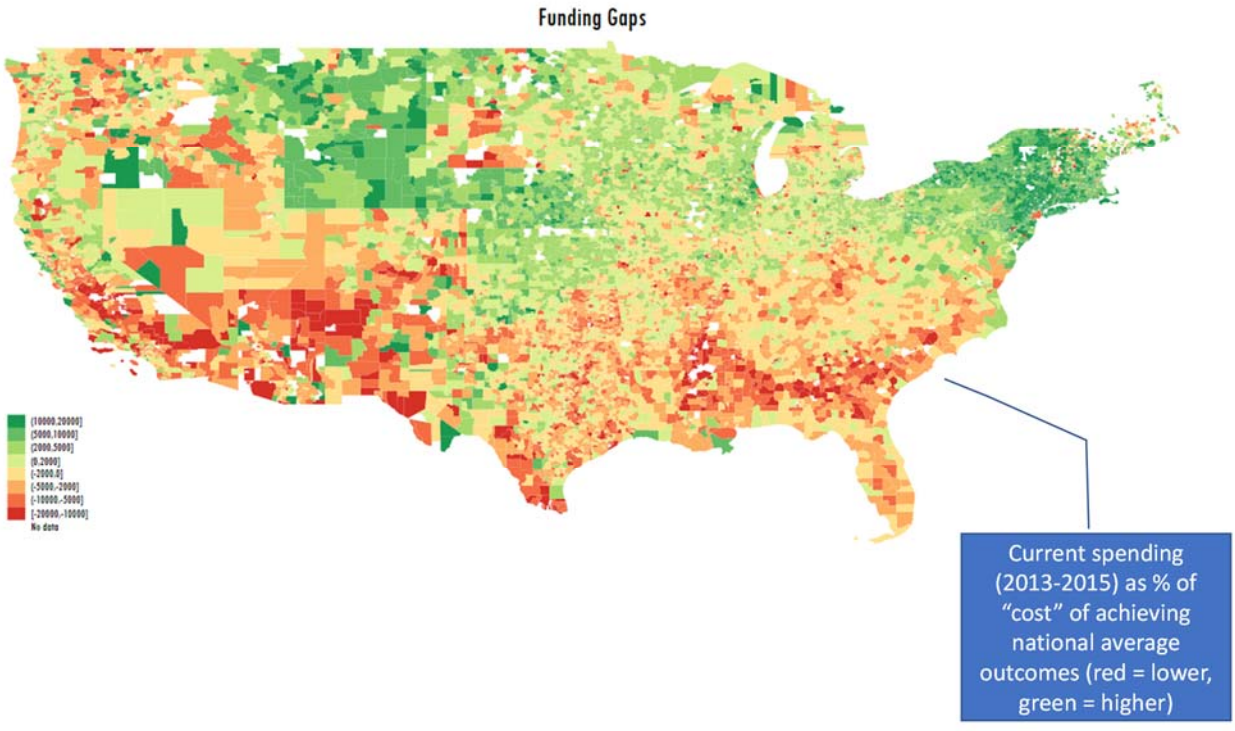
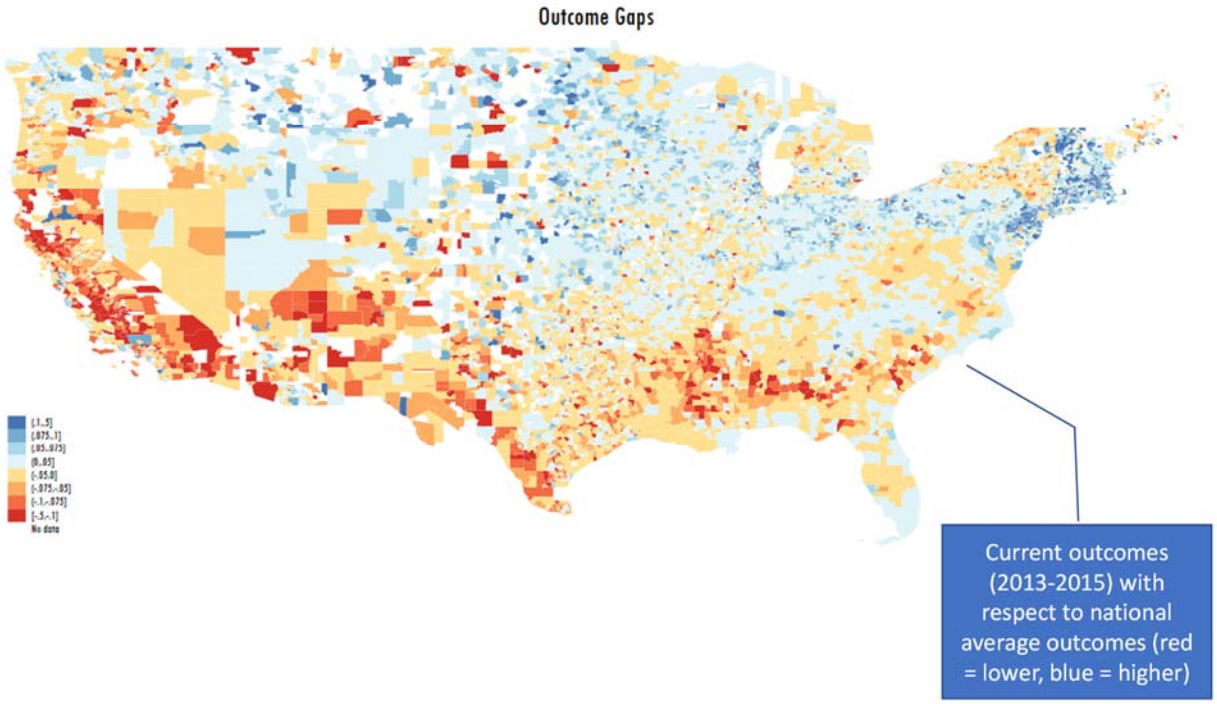



Figure 7, when viewed together with Figure 6, shows the close relationship between spending and outcomes. Many districts in Northeastern states have actual outcomes that significantly exceed national average outcomes, whereas districts in states with the most severe funding deficits also

appear to have outcomes that fall furthest below national average outcomes. Put bluntly: state and local investment matters. States and local districts in the South and Southwest are not investing sufficiently to approach even national average outcomes in the majority of their schools, and the actual outcomes in those schools are suffering. As we note below, however, these relatively low-spending states have different capacities for raising revenues, due to variations strength of their economies. To put it simply: some states may choose to spend less on their schools, while others may be less able to spend more.

**Figure 7**




The next three figures (Figs. 8-10) present aggregations of district spending and outcome gap estimates to within-state poverty quintiles. Note that the highest poverty quintile within some states is, of course, much higher in poverty than the average poverty quintile in other states. We begin in Figure 8 with the middle quintile for each state. Again, in several states, middle quintile poverty districts spend far more than enough to achieve national average outcomes; in return, they do achieve above-national-average outcomes. Particular standouts include Massachusetts, New

Jersey and Connecticut. Interestingly, New York, which spends at similarly high levels in its districts, does not exceed national average outcomes. Some insights might be derived from our maps as well, where relatively low need/cost upstate New York districts spend higher than their predicted need, but do not perform commensurately.

Wyoming, often chastised for inefficient high spending[43], at least for median poverty districts, falls in line with expectations – having outcomes in line with its relatively high spending. Mississippi, California, Georgia, New Mexico, Arizona and Alabama all spend well below needed levels to achieve national average outcomes, and all perform well below national average outcomes. Louisiana has a smaller spending deficit relative to need but a consistently large outcome deficit relative to national average.

**Figure 8**

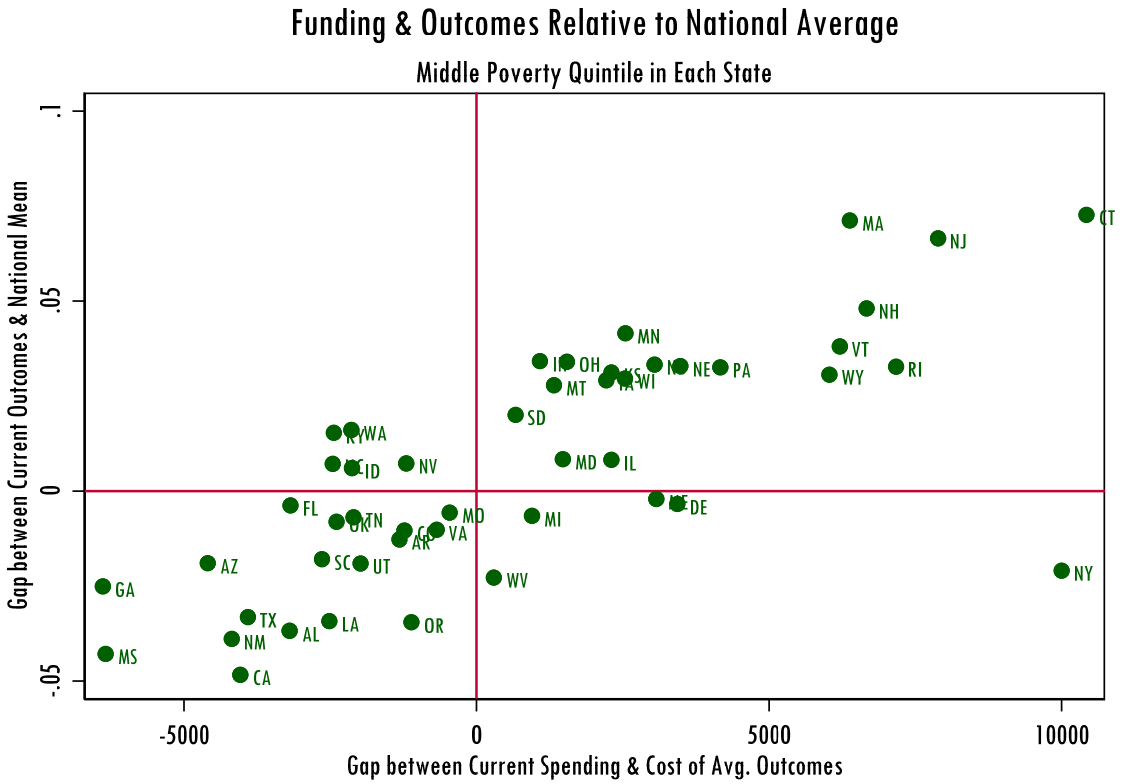
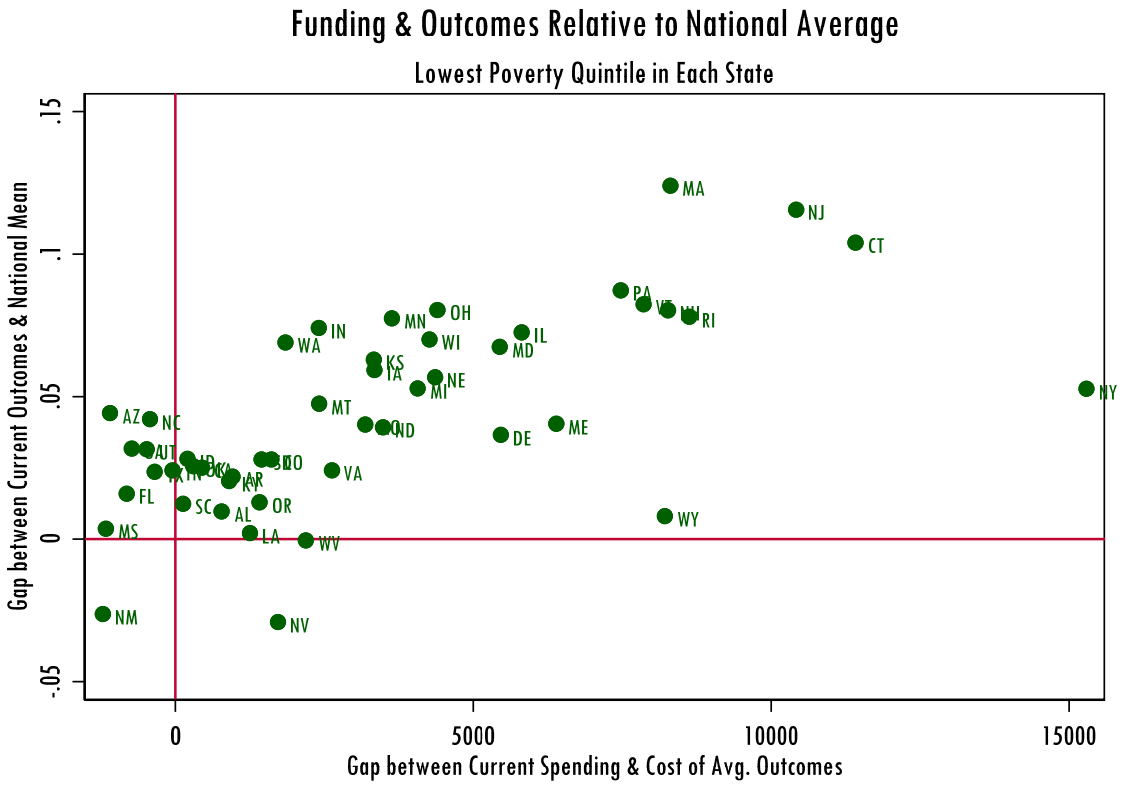



Figure 9 shows that, in most states' lowest poverty districts, funding is at or above levels needed to achieve national average outcomes, and in most states, districts in the lowest poverty quintile, on average, achieve at least national average outcomes. West Virginia's, Louisiana's, and

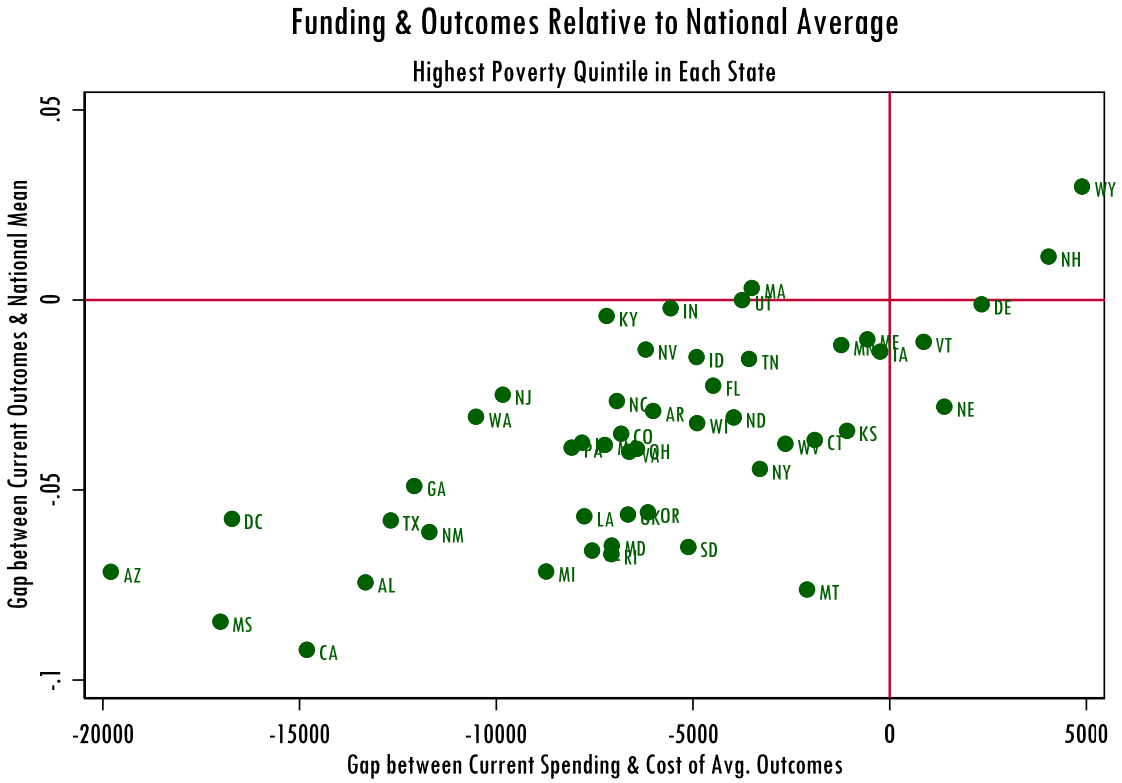
Nevada's low poverty districts might seem to spend efficiently, but they underperform relative to other states given their spending. Two states – Mississippi and New Mexico – spend so little on average that even their lowest poverty districts can't achieve national average outcomes.

**Figure 9**




Finally, Figure 10 shows the pattern for the highest poverty quintile of districts in each state. Only a few states – those with relatively low poverty even in their highest poverty districts – have high-poverty districts that are sufficiently funded and producing sufficient outcomes, relative to national averages. Others are relatively close, including Vermont and Minnesota. In stark contrast, in California, Mississippi and Arizona, the highest poverty districts fall on average more than $15,000 per pupil below levels predicted to achieve national average outcomes, and outcomes in high-poverty districts in these states are disturbingly low. Alabama, New Mexico, Michigan, South Carolina, Georgia, and Tennessee are not far behind in that they also have very low per-pupil spending and low outcomes relative to the national average.

Figure 10




Our final two figures in this section present a simplified perspective using our quintile data on spending gaps (quintiles for all states listed in Appendix A). Figure 11 shows current spending per pupil and predicted costs of achieving national average outcomes for two relatively low-poverty states, one in a high-cost, population dense region (New Jersey) and another in a generally low-cost region (Kansas). While New Jersey's most affluent quintile of school districts can achieve national average outcomes with as little as $6,000 per pupil, these districts spend on average over $15,000 per pupil (from 2013 to 2015). Given this reality, it would be absurd for policy makers to propose any distribution of state aid that sends even more revenues to these districts.[44] However, it is highly unlikely that the parents of children in these districts (or even the non-parent, property owning taxpayers, whose property values are tied up in the effectiveness of their local schools) would endorse merely average outcome standards. Nor is it a rational policy goal to simply cut funding and lower standards for a state which competes so favorably on the international stage. The more rational alternative is to ensure equal opportunity for children across New Jersey districts to achieve at least New Jersey's current high outcome standard, and to move more states toward similarly high outcomes.

Figure 11 also shows that, on average, high-poverty New Jersey districts spend marginally more than their lower-poverty neighbors, but cost estimates suggest that even this spending is

insufficient. Again, these districts face the combination of very high poverty, high population density and high labor costs. Our model shows empirically that these factors require significantly more spending to achieve equal educational opportunity.

Both current spending *and* cost estimates are lower in the Kansas context than in New Jersey. Lower-poverty quintiles of Kansas districts also spend more than needed to achieve merely national average outcomes. Higher-poverty districts fall just short of needed funding to rise to the national average outcome level during the period from 2013-2015. However, most Kansas districts experienced significant funding cuts during and after this period, suggesting that current spending-vs.-average-outcome deficits may be greater than illustrated here.[45] Further, spending-vs.-average-outcome deficits for the highest poverty districts (Kansas City, KS in particular) are much larger than the average among all those in the high poverty quintile (we further explore this difference below). Districts (and children) in both of these states have benefited over time from judicial pressure on their legislatures to maintain adequate levels of overall funding and to target funding to areas of greater need. Nevertheless, that pressure has been insufficient to resolve remaining inequities and inadequacies in the highest poverty districts in these states.

**Figure 11**

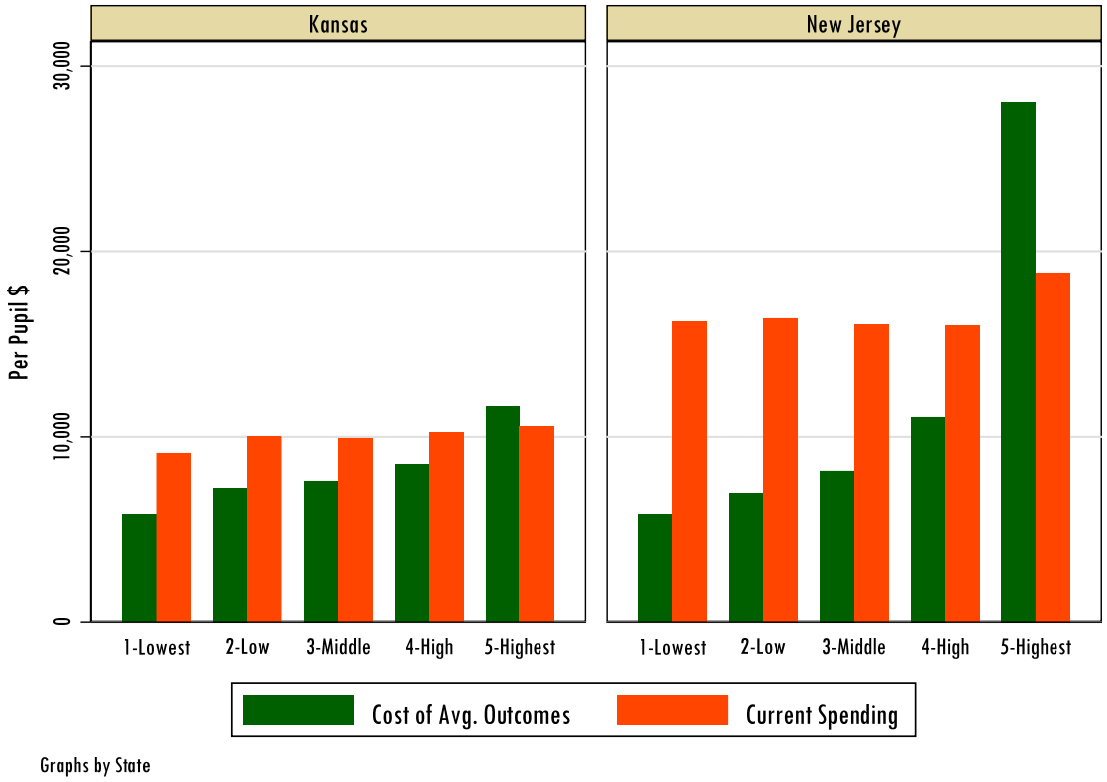
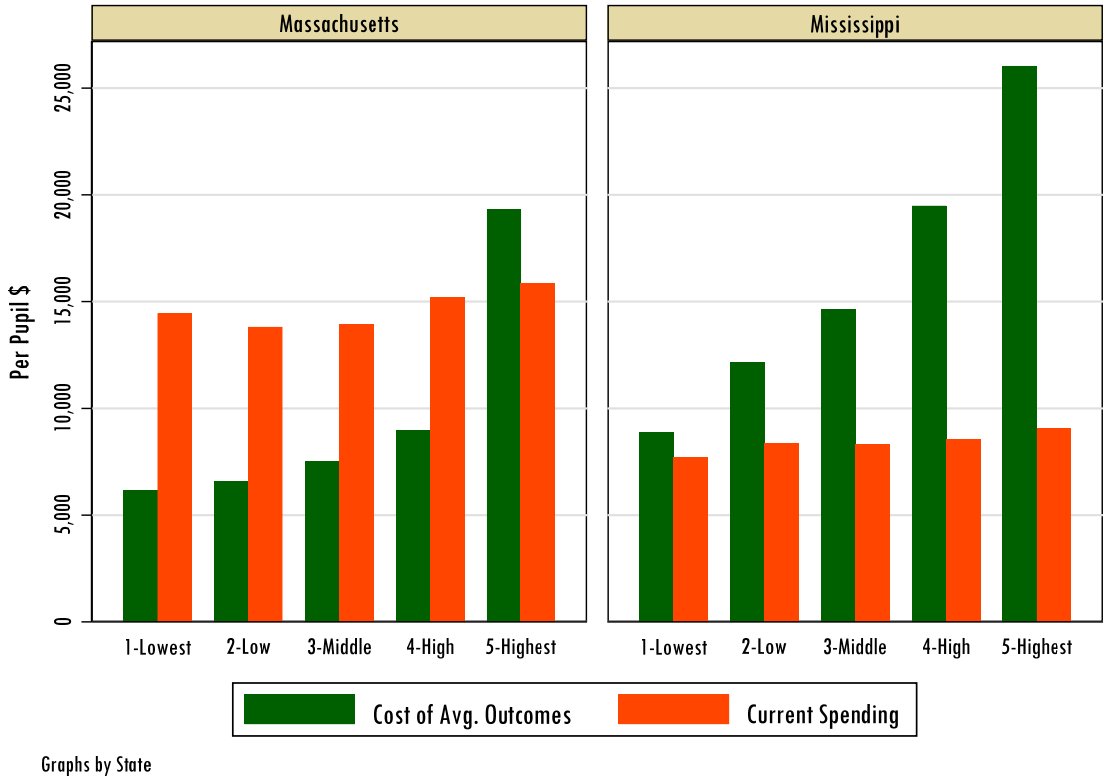


Figure 12 illustrates an even more striking contrast: Massachusetts (an affluent, high-achieving state) versus Mississippi (a high-poverty, low-achieving state). In Massachusetts, only districts in the highest poverty quintile of districts face deficits in spending needed to achieve national average outcomes, whereas in Mississippi, *all* districts face deficits in spending needed to achieve national average outcomes. Indeed, districts in Mississippi's highest poverty quintile of districts are projected to need *three times* their current funding levels or more to approach national average outcomes.

**Figure 12**



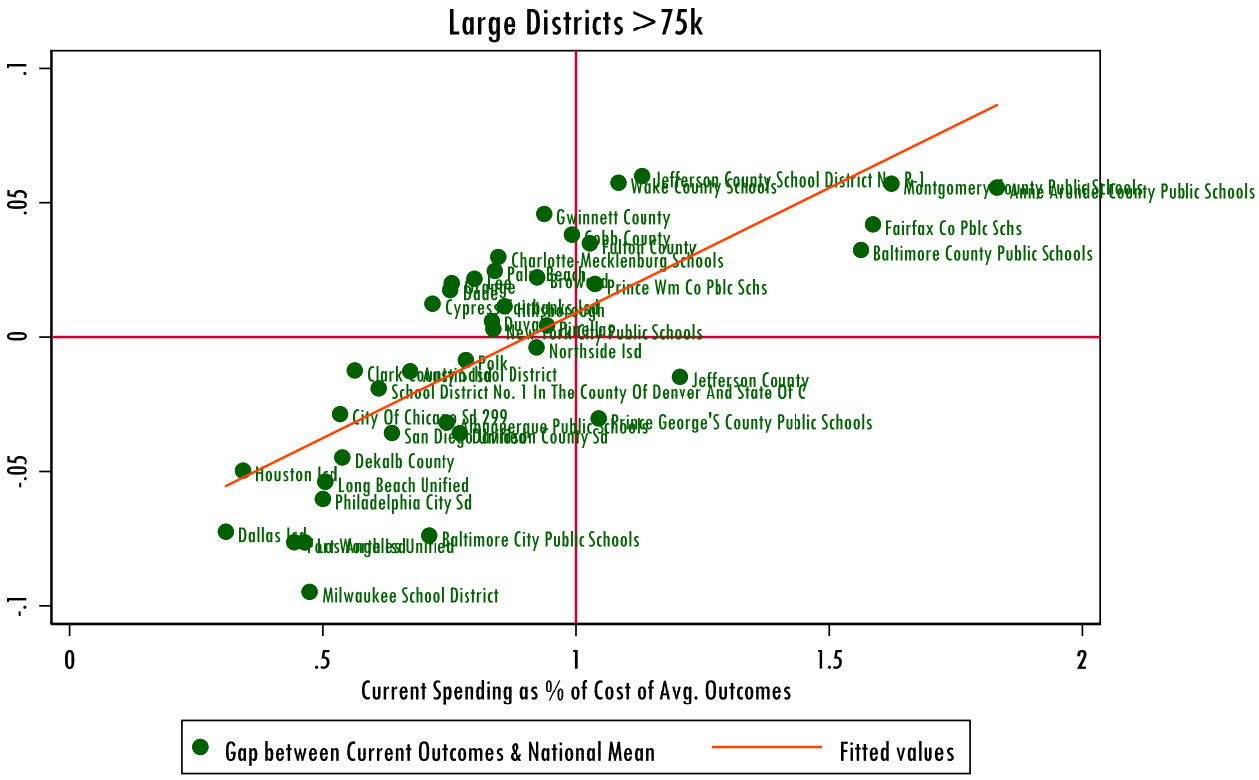

### *Large Districts*

Here, we take a brief look at the position of large school districts: those enrolling over 75,000 students in 2013. On average, large districts exhibit the same relative variation in outcomes and spending, and the same correlation between spending and outcomes, as the entire population of United States school districts. Here, the horizontal axis indicates the ratio of current spending levels to predicted spending levels needed to achieve national average outcomes. Some large districts, such as Montgomery County, Maryland – a relatively affluent suburban county outside of Washington, DC – spend more than 1.5 times what they would need to achieve merely average

outcomes; in turn, they achieve well above the national average. The same goes for the Fairfax County, Virginia school district.

By contrast, Houston Independent School District in Texas spends somewhat less than half of what would be needed to achieve national average outcomes; consequently, it falls in line with expectations, achieving well below national average outcomes. Milwaukee and Baltimore City schools also face significant funding shortfalls and perform even less well than expected. Chicago and Philadelphia face substantial funding shortfalls and perform below national averages, yet near expectations. Many of the nation's largest cities require substantial increases – in some cases, doubling – of their current spending levels in order to approach national average outcomes. New York City schools presently achieve near national average outcomes and are estimated to fall only slightly short of the spending they would need to achieve at the national average outcome level.

**Figure 13**




### Within-State Adequacy of Resources

Insights can also be derived from the National Education Cost Model regarding the relative adequacy of resources across districts within states – specifically to identify those districts where children are most likely deprived of equal opportunity to achieve relatively modest (national average) outcome goals. We should remember, however, that the model is based on a national dataset; variations in the model when the data is restricted to individual states are to be expected.

The formation, therefore, of precise district-level predictions (dollar values of gaps) based on the NECM requires close scrutiny and specific state level follow-up analyses to guide state-specific reforms. This said, it would be useful, as a first step, to use the model to explore within-state variations in spending and outcomes.

Figure 14 shows that, despite overall robust levels of funding in Massachusetts, some districts fall short of spending levels required by prediction to achieve national average outcomes. These districts include western Massachusetts cities of Holyoke and Springfield, as well as Chelsea, adjacent to Boston. Meanwhile, the suburbs of Boston, including Lexington and Wellesley, are spending nearly three times what they would need to achieve; consequently, they are far exceeding national average outcomes.

Figure 15 shows similar patterns in Connecticut, where districts facing the most significant funding deficits also face outcome deficits. These districts include New Britain and Bridgeport, two cities that even in nominal spending terms are significantly disadvantaged.[46]

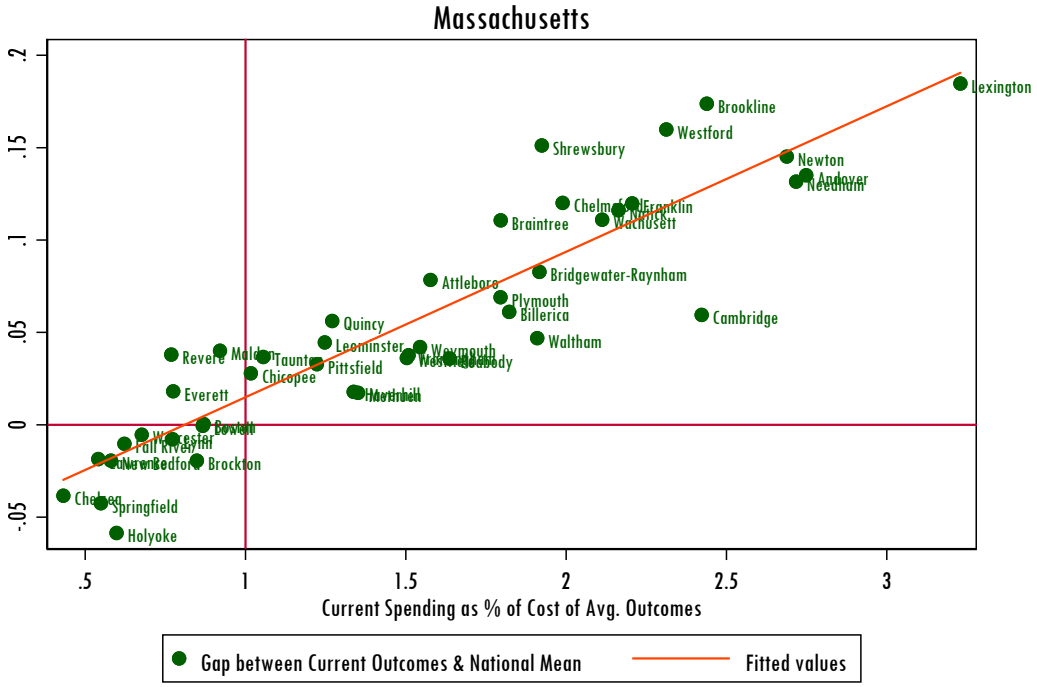
Figure 16 shows Kansas district funding and outcome gaps related to achieving national average outcomes. In Kansas, while the average gap for the highest poverty quintile was not very large, the gap for districts like Kansas City remains very large. The Kansas City, KS district in 2015 spent only somewhat more than half of what was needed to achieve national average outcomes. A handful of other districts, including Liberal and Turner (carved out of Kansas City), also face significant funding and outcome gaps.

Pennsylvania has long been one of the most disparately-spending states in the nation. Even in terms of unadjusted spending, school districts including Philadelphia, Reading and Allentown have long been recognized as severely financially disadvantaged. In Figure 17, we see that these districts only spend about half of what they would need to achieve national average outcomes, and perform commensurately. By contrast, the Lower Merion district, immediately adjacent to Philadelphia, spends nearly *four times* what it would require to achieve national average outcomes; as expected, it far exceeds national average outcomes.

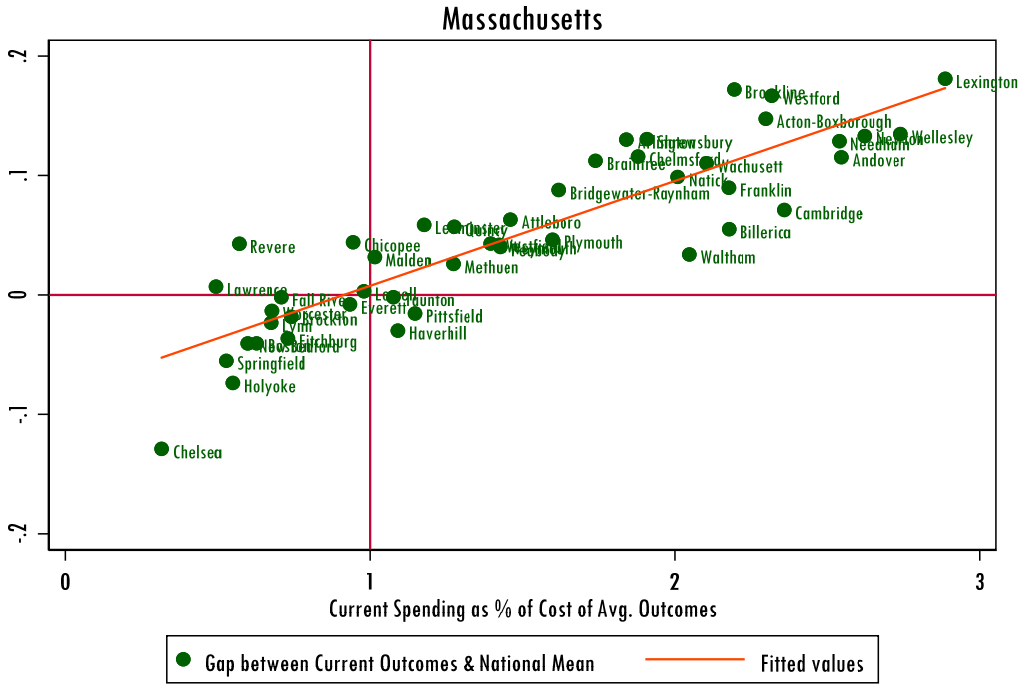
Finally, Figure 18 shows Illinois disparities. Like Pennsylvania, Illinois school districts have exceptionally large disparities in spending. Here, East St. Louis is an extreme case of a severely underfunded district that performs even less well than one might predict when compared to similarly situated districts. Chicago Public Schools are also significantly underfunded and fall short of national average outcomes; however, CPS performs marginally above expectations (the diagonal trendline). Other severely underfunded and commensurately underperforming districts include Aurora East, Cicero, Joliet and Waukegan, among many others.

## Figure 14

2013

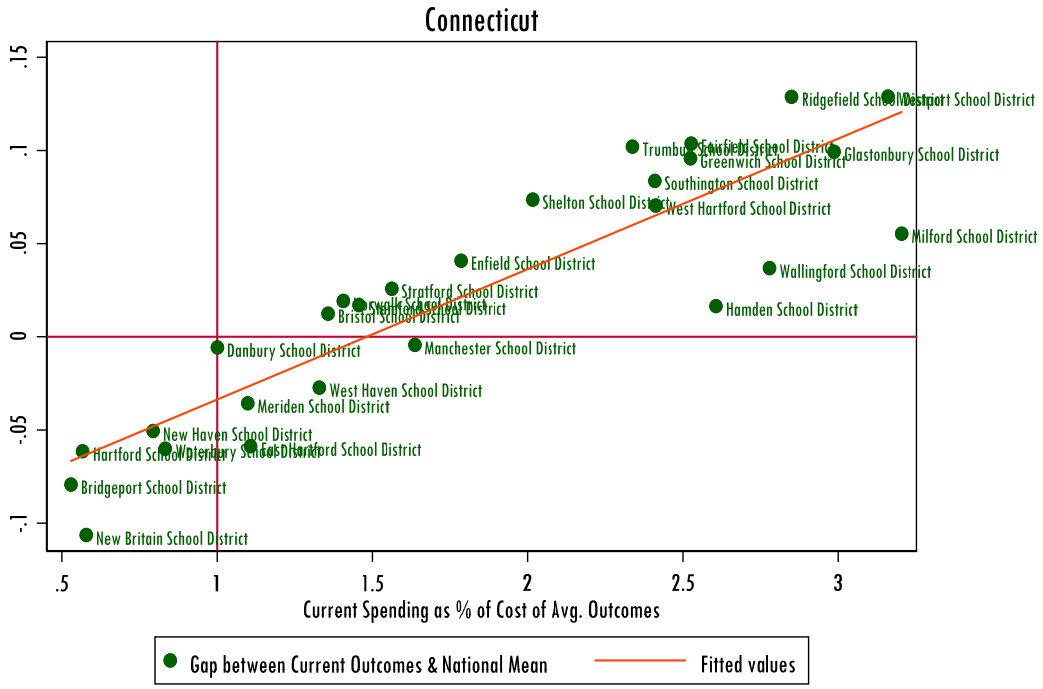



2015

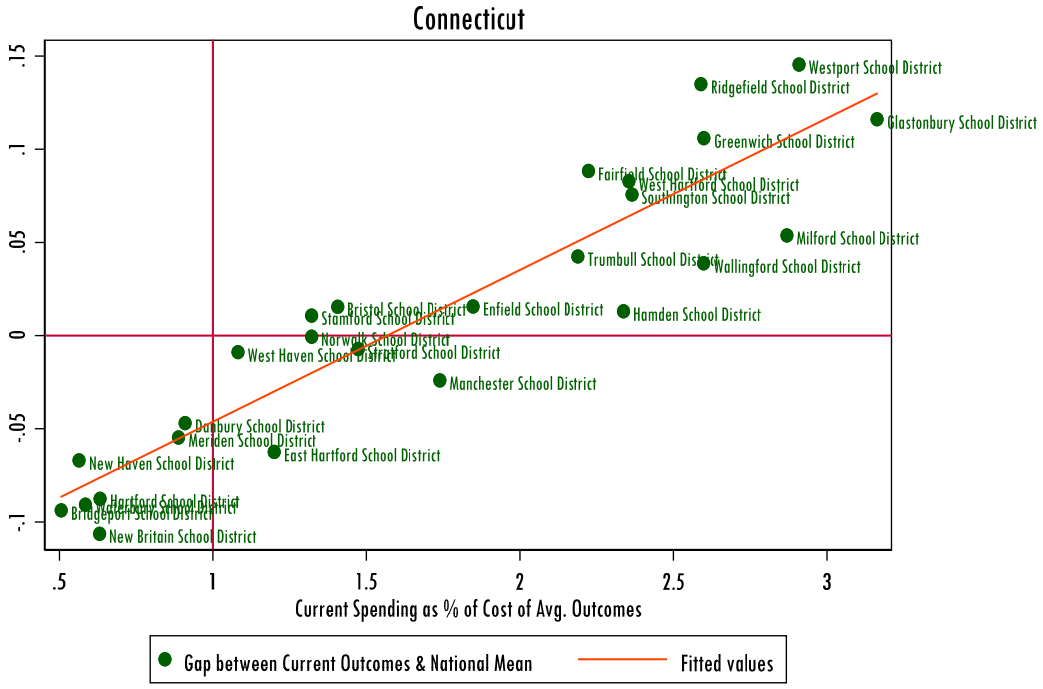


## Figure 15

2013

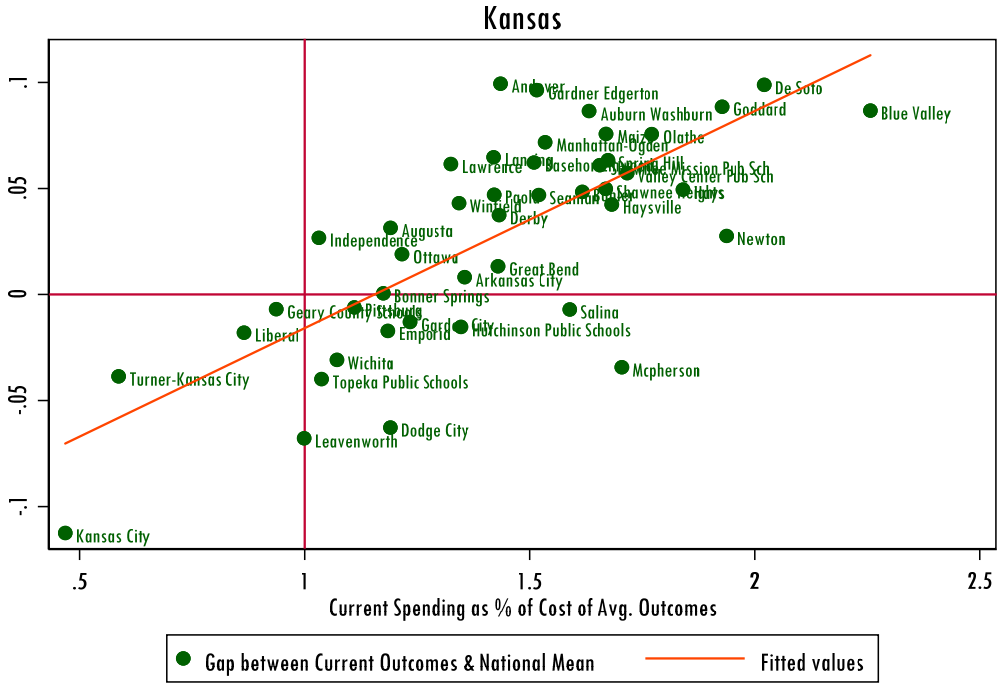



2015

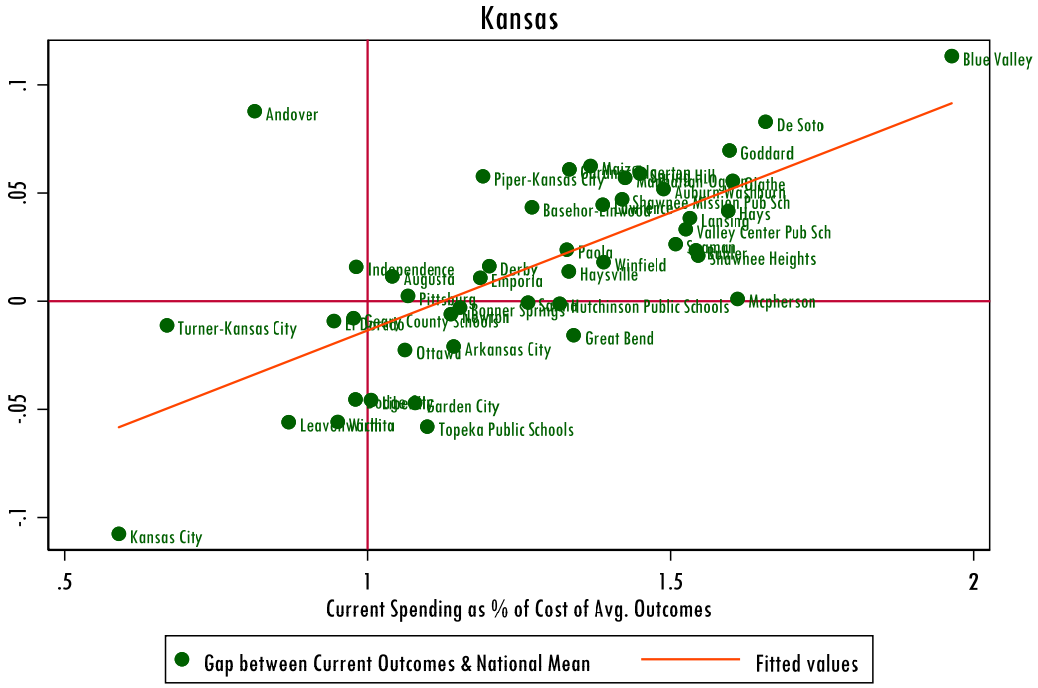


## Figure 16

2013

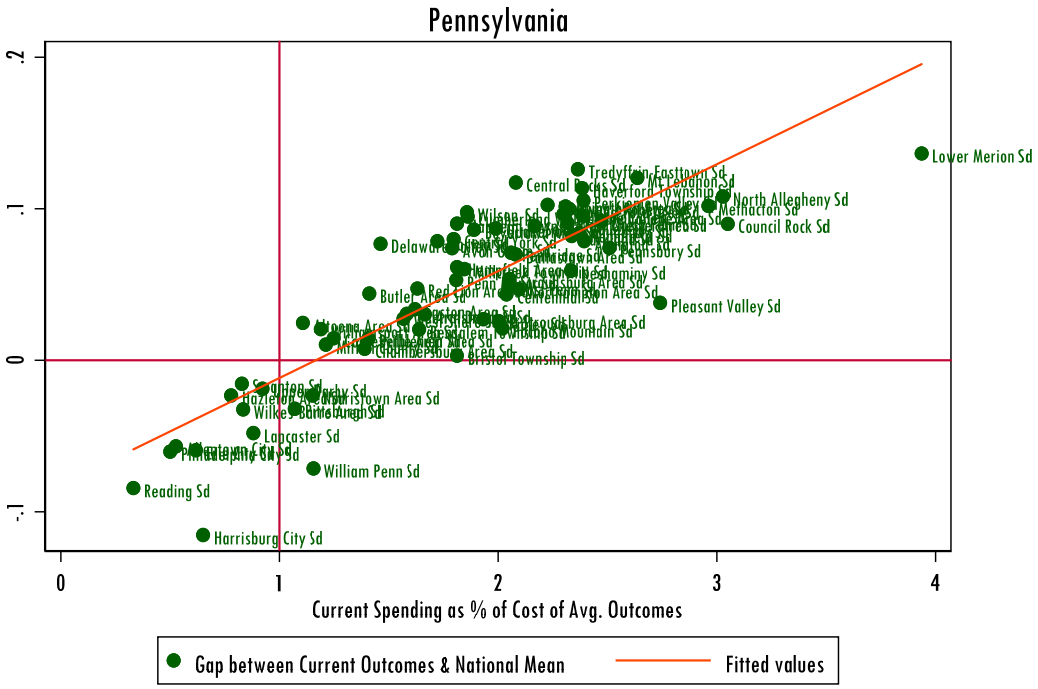



2015

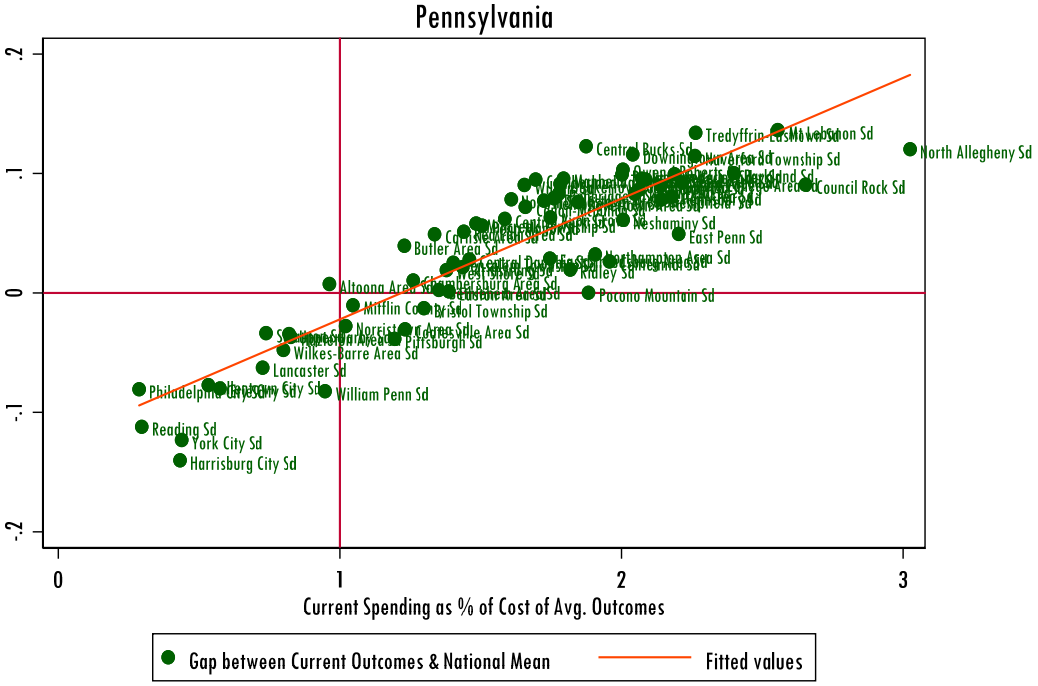


## Figure 17

2013

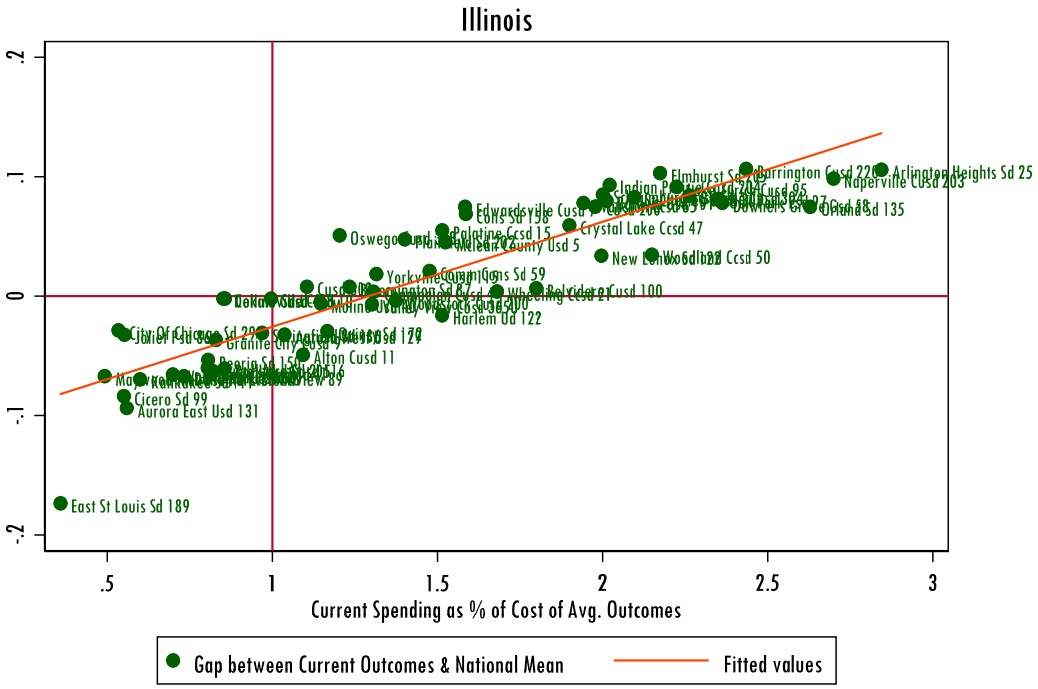



2015

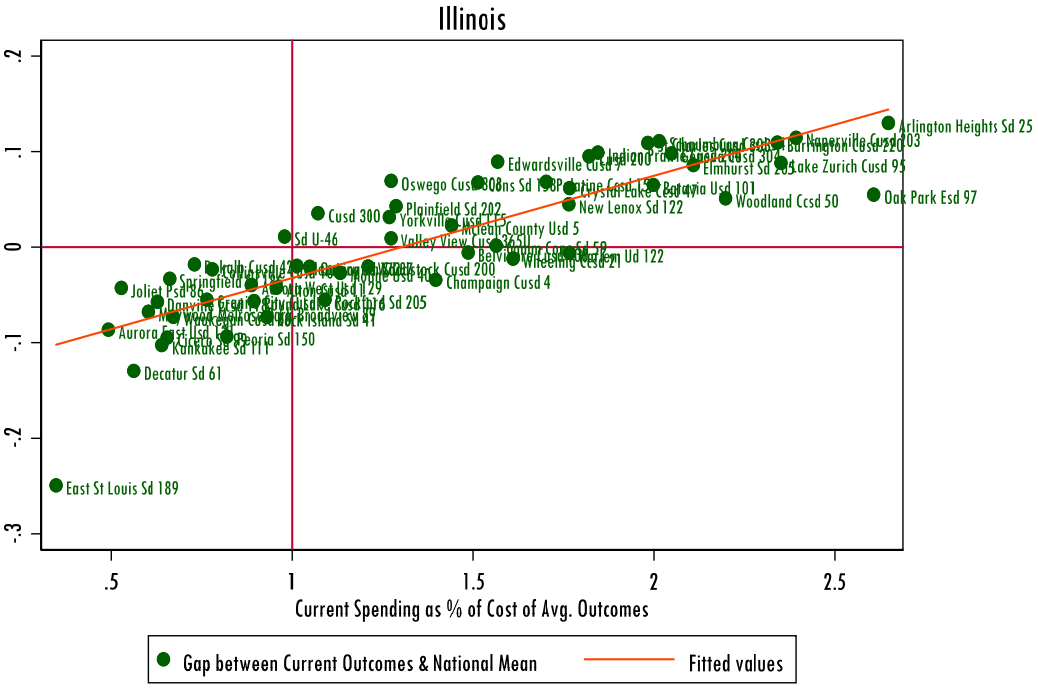


## Figure 18

2013




2015



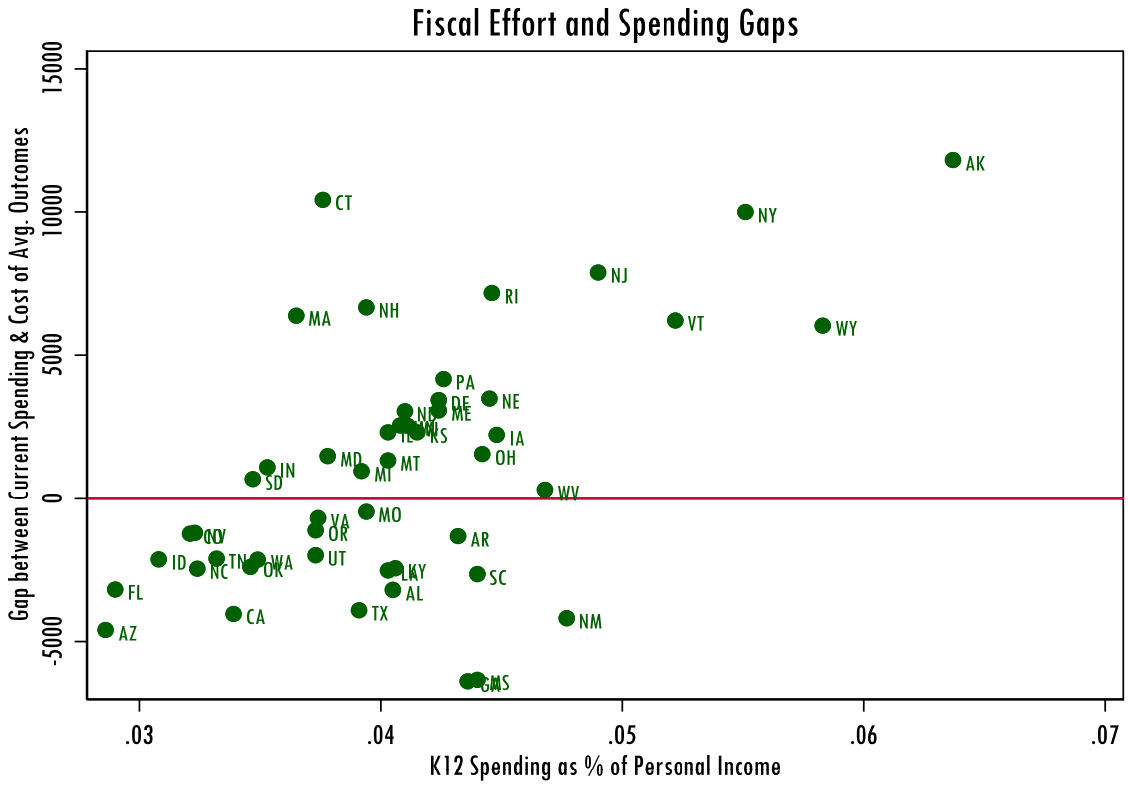
### The Capacity for Adequacy

Finally, Figure 19 addresses the question of state capacity to provide greater support to close existing spending gaps. Figure 19 specifically focuses on the relationship between spending gaps for the middle poverty quintile of districts and each state's current level of effort, which is measured as the share of Aggregate Personal Income raised and expended in state and local revenue on elementary and secondary public schooling. We use this measure in place of the percent of the state budget spent on education because the state budget constraint itself is a policy consideration tied to preferences for lower taxes. As we note above: low-spending states vary in their ability to raise additional revenues for their schools. Some states may simply choose to have low taxes, small school budgets, and insufficient services across the board, despite having the capacity to spend much more. Other states with weaker economies may wish to spend more on schools, but have legitimate capacity constraints. Here we focus on the states' economic *capacity* to raise revenue, not its *choice* to raise revenue.

Figure 19 shows that Arizona, in particular, has among the lowest effort levels among all states coupled with the largest funding gaps for its high-poverty schools. Contrast this with Arizona's neighbor, New Mexico, which also has sizeable spending gaps but currently applies much greater effort of its own toward financing public schools. Mississippi is clearly in need of the greatest external assistance, having huge gaps in spending to achieve national average outcomes, not just for high poverty but for all districts, and already levying greater than average effort considering its relatively low economic capacity.

## Figure 19

Gaps for middle poverty quintile districts and current levels (2013-2015) of state & local funding effort




## Conclusions & Policy Implications

This paper presents a first attempt at better understanding interstate (as well as within-state) variations in the costs associated with achieving average student outcome goals across districts serving children of different poverty or family income levels. We take advantage of two recently released national data panels — applying methods used previously for inter-district, within-state analyses of the costs of meeting common student achievement outcome standards — to produce a new National Education Cost Model (NECM). The findings derived from this model are the first based on an empirical analysis of national education spending and outcome data, and are quite striking. Specifically, we find that:

- Most states fall below necessary funding levels for their highest poverty children to achieve national average outcomes;

- When focused on the relatively modest goal of achieving current national average student achievement outcomes in reading and math, high-poverty school districts in several states fall thousands to tens of thousands of dollars short, per pupil, of funding required to achieve that goal;
- More disturbingly, in some states — including California, Arizona, New Mexico, Mississippi, Alabama, Georgia, Tennessee, among others — all but the lowest poverty quintile of districts (and in some cases even these districts) have insufficient funding to achieve national average outcomes;
- Meanwhile, a handful of states — including Massachusetts and New Jersey — are relatively better in terms of average levels of funding across districts in each poverty quintile, and the extent to which additional resources are targeted to higher-poverty schools; consequently, student outcomes, which flow from these more sufficient funding levels, are significantly improved (even if gaps between high- and low-poverty districts remain).

The evidence shows that states are currently applying vastly different effort (i.e., spending relative to fiscal capacity) toward remedying their own districts' shortcomings. While the estimates of education costs provided herein at the individual district level are imprecise, they are nonetheless useful in the absence of any other rigorously derived guidance. Some findings for individual districts — and even for entire quintiles of districts within states — suggest extreme disparities that necessitate very costly remedies. Our models suggest that, in some states, the highest poverty quintile of districts fall as much as $14,000 to $16,000 per pupil below necessary spending levels. While these models may (or may not) overestimate these spending deficits, we can safely assume that very high poverty districts in, for example, some parts of California or in the lower Mississippi delta do require a huge infusion of additional funding to achieve more adequate and equitable student outcomes.

Even with relatively high effort, some states simply lack the capacity to close the gaps we have identified. These interstate variations speak to the need for a new and enhanced federal role in improving interstate inequality in order to advance our national interest in improved education outcomes across states. Our empirical model shows that federal funding for schools has been insufficient for improving interstate inequality. Arguably, the interstate gaps we have presented strike at the core of our national interest and call for urgent federal action in two fundamental ways:

First, substantial portions of PK-12 federal education funds should be pooled and targeted to resolve these disparities, with particular emphasis on raising spending levels in states (Mississippi and New Mexico, for example) with large spending gaps and little fiscal capacity of their own to remedy those gaps.

Second, the federal government should use its bully pulpit to encourage low-effort, higher-capacity states with large school funding shortfalls and inequities (Arizona, Texas, and California, for example) to take appropriate steps to resolve those inadequacies and inequities. In short, the federal government must act to reduce inequality both within and between states in furtherance of the national interest. Similarly, the federal government should not impede the ability of states making greater efforts to fund their schools to continue doing so. States that are pursuing policies that drive more funding where it is needed should be encouraged to continue, and even expand, those policies. Our analysis shows that, on average, states that spend more get better outcomes; the federal government should not drag these states down, but rather lift the others up.

Finally, we note that the above policy recommendations are in stark contrast to the direction of recent educational reform efforts, which are based in part on a flawed notion of a "national" failure on the part of U.S. to perform well on international assessments in comparison with other nations. This failure is commonly decried by political operatives, pundits and popular media, but U.S. scores on such assessments fail to capture a) the heterogeneity of outcome variation across U.S. states, and b) the heterogeneity of state and local investment in improving those outcomes. In other words: because states vary so much in what they spend and how they perform – even when controlling for differences in students and other important factors – it makes little sense to bundle the nation's school districts together, compare them as a group to the rest of the world, and universally declare them a "failure."

Unfortunately, pundits often use these false international comparisons to assert that money (i.e., school funding levels) doesn't matter and that U.S. schools, whether in Massachusetts or Mississippi, require massive structural reform and disruptive measures – including market-based incentives and competition, the proliferation of charter and voucher schools, the elimination of employee job protections, mass closures of "failing schools," and the statistically driven elimination of "bad teachers." Rarely, however, do education reform advocates acknowledge the egregiously uneven investment in public schooling across states and its relation to the divergent quality and performance of individual state education systems.

It's time to discard the notion of a failure in educational outcomes as a national problem, applying similarly to Massachusetts and Mississippi, or to New Jersey and Arizona, or to the southern and northeastern regions. Real remedies to the maladies of U.S. schooling must be focused on the states, the responsible unit of government for the education of our nation's children. Improving state school systems requires new and meaningful investments, targeted at substantially raising the level of school funding in those states — and in particular districts within those states — that, over time, have seriously neglected and shortchanged thousands of their schools and millions of students. In conclusion, the true shame of our nation stems not from an aggregate failure in student achievement, but from our collective inability to address urgent achievement and spending deficits not only within but between districts and states.

## Appendix A

### *The Circular (Endogenous) Relationship between Spending & Outcomes*

A concern in cost function models is that the outcome measures in question are "endogenous." That is, while public desire for higher outcomes costs more money, it is also true that the dependent variable in the model, the money variable, influences outcomes. The most common approach for accounting for the endogeneity of outcomes in peer-reviewed cost function literature is to estimate an instrumental variables, or two-stage least squares cost function. In an instrumental variables or "two-stage least squares" specification, the goal is to identify a set of fully "exogenous" instruments, or measures that may be used to predict the endogenous variable but are not directly statistically related to the dependent measure – spending.

A common approach for selecting instruments for the outcome measure in the education cost function is to identify measures of the competitive context in which each school district operates. For example, one could use indicators of the education level of the adult population in surrounding districts, or measures of contrast between the observed district and surrounding districts, which might indicate competitive pressures to improve educational outcomes at any given spending level. In short, district outcomes are assumed to be, at least in part, a function of the competitive context – the "neighborhood" – in which a district operates.

$$\textbf{Outcomes}_{dj} = f(\textbf{Neighborhood Competitive Context}_{dj})$$

Instrument selection is an iterative process involving consideration of both conceptual appropriateness of instruments and statistical tests of instruments. Following standard protocol, instruments are tested for relevance – that they predict variance in the endogenous measures – and that the instruments are valid, uncorrelated with the error term and correctly excluded from the main equation.

## Appendix B

### *Controlling for Inefficiency*

It would be difficult, if not impossible, to observe a single school district in isolation to determine the inefficient share of spending — that is, the share of spending that does not contribute to improvement of measured outcomes. However, when looking across many school districts of both similar and different characteristics, it is possible to detect variation in spending that is not explained by differences in outcomes or cost factors. Among similar sets of school districts based on observed characteristics, some spend more or less than others to achieve any given outcome level. The higher levels of spending may be considered less efficient spending and the lower levels more efficient spending for comparable outcomes, assuming one has fully captured factors outside of district's control that affect the cost of outcomes.

This assumption is also influenced by the particular outcomes measured in the model. If a school or district is spending on physical education, sports, and/or music and arts for its children; if those expenditures do not have as strong a direct effect on reading and math test scores; and if the model is based on reading and math test score outcomes alone, then those expenditures might be considered less efficient with respect to the tested outcomes. In short, efficiency is a highly circumscribed measurement: Some districts are more or less efficient than others at producing *specific* outcomes and can only be evaluated and/or controlled for in education cost functions to the extent that the efficiency, as measured by the impact on discrete outcomes, varies from one district to the next.

It is important to acknowledge that the response to inefficiency can also raise equity concerns. In the context of educational adequacy claims or adequacy-oriented school finance policies, one might argue that districts whose children fall below adequacy standards on specific assessments should be required to allocate all resources toward the direct improvement of those outcomes and those outcomes alone. That is, higher-need districts that are more likely to be underperforming should be required to operate at maximized efficiency (on measured outcomes only) and the state should fund those districts at the level necessary to achieve adequate outcomes assuming maximized efficiency. But lower-need districts that already have sufficient resources to exceed adequate outcomes are exempt from such requirements. Such differential efficiency expectations are plainly and obviously inequitable.

Such differences in efficiency requirements placed on higher- versus lower-need districts can also lead to dramatic inequities in the breadth of educational opportunities available to children. What might be characterized as inefficient frills include not only instrumental jazz or ceramics classes, but also include advanced course offerings in math, social sciences, foreign language, and science, which are critical prerequisites for students competing for limited slots in competitive colleges or universities.

A common approach for accounting for inefficiency in peer-reviewed education cost function literature is to identify factors that vary across school districts that might explain some of the differences in spending that are not directly associated with the measured outcomes. These indirect inefficiency factors are typically organized into two groups: fiscal capacity factors and public monitoring factors. Fiscal capacity factors may include the median income of communities, taxable property wealth, or other factors that may allow local homeowner voters to more easily raise revenue for schools with potentially less consideration for the extent to which each additional dollar translates to improved measured outcomes. It is also conceivable that higher fiscal capacity communities are more likely to support spending on unmeasured outcomes and may place equal or even greater value on those outcomes than on the measured outcomes. Public monitoring factors include characteristics of school districts that may lead local homeowner voters to be more or less critical of the extent to which each additional dollar translates into improved measured outcomes. For example, local school districts receiving larger shares of funding from the state rather than local property tax sources may have reduced local public monitoring, although state accountability monitoring may offset this reduction.

$$\textbf{Inefficiency}_d = f(\textbf{Fiscal Capacity}_d, \textbf{Public Monitoring}_d)$$

***"Inefficiency" as Missing/Omitted Variables Bias***

It is important to understand that, in statistical terms, correcting for inefficiency in a cost model is an *omitted variables bias* problem. That is, we are simply trying to identify factors that explain differences in spending that are neither associated with legitimate cost differences nor with differences in outcomes. Other approaches for addressing inefficiency, such as stochastic frontier models, fail to address this omitted variables bias problem. Rather, these other approaches simply assume that districts on the edge of the distribution (of a pre-determined shape) are most efficient and that deviations from that frontier (based on a pre-determined error distribution) indicate inefficiency. We have come to believe over time that the approach of including indirect *inefficiency* corrections for variations in spending is more thorough and likely more accurate, especially when used for the purposes herein.

Further, the understanding that these inefficiency controls address omitted variables bias clarifies important differences between education cost functions and education production functions, and validates why the cost function is the appropriate tool for the task at hand. In an education production function, the goal is to estimate the extent to which spending, as an independent variable, affects the dependent outcome measure. While the cost model evaluates the extent of *spending* variation (dependent measure) associated with outcome variation (independent measure), controlling for cost factors and correcting for inefficiency, the production model attempts to evaluate the extent of *outcome* variation that results from spending variation, controlling for other factors. Some have asserted that a viable validity check on the education cost model is to see if it produces the same results – the same predictions – as an education production

function estimated with the same data.[47] But, in a production function, measured outcomes are the dependent variable and spending is one of the independent variables, and there is no comparable, statistically reasonable way to correct for inefficiency in the spending measure when the spending measure is among the independent variables.

## Appendix C

Estimates by Poverty Quintile for All States

| State | Poverty Quintile | Cost Index Mean | Cost of National Average Outcomes | Current Spending per Pupil | Gap between Current Outcomes & National Mean (sd) | Gap between Current Spending & Cost of Avg. Outcomes | Current Spending Adjusted for Cost of Avg. Outcomes |
|---|---|---|---|---|---|---|---|
| Alabama | 1-Lowest | 0.69 | $7,991 | $8,767 | 0.010 | $776 | $13,072 |
| Alabama | 2-Low | 0.90 | $10,649 | $8,888 | -0.020 | -$1,762 | $10,005 |
| Alabama | 3-Middle | 1.04 | $12,102 | $8,907 | -0.037 | -$3,194 | $8,673 |
| Alabama | 4-High | 1.29 | $15,220 | $8,926 | -0.047 | -$6,294 | $7,081 |
| Alabama | 5-Highest | 1.95 | $22,898 | $9,573 | -0.074 | -$13,325 | $5,198 |
| Alaska | 1-Lowest | 0.74 | $8,338 | $16,685 | 0.004 | $8,347 | $22,544 |
| Alaska | 2-Low | 0.87 | $10,192 | $17,388 | 0.008 | $7,196 | $20,101 |
| Alaska | 3-Middle | 1.51 | $17,900 | $29,714 | -0.069 | $11,814 | $20,357 |
| Alaska | 4-High | 1.90 | $22,293 | $30,799 | -0.139 | $8,506 | $16,316 |
| Alaska | 5-Highest | 2.63 | $30,384 | $29,229 | -0.149 | -$1,552 | $11,419 |
| Arizona | 1-Lowest | 0.67 | $7,810 | $6,712 | 0.044 | -$1,098 | $10,296 |
| Arizona | 2-Low | 0.88 | $10,200 | $6,885 | -0.004 | -$3,315 | $7,886 |
| Arizona | 3-Middle | 1.07 | $12,282 | $7,688 | -0.019 | -$4,594 | $7,281 |
| Arizona | 4-High | 1.37 | $16,132 | $7,728 | -0.041 | -$8,404 | $5,807 |
| Arizona | 5-Highest | 2.36 | $27,371 | $7,756 | -0.072 | -$19,798 | $3,611 |
| Arkansas | 1-Lowest | 0.68 | $7,940 | $8,900 | 0.022 | $960 | $13,291 |
| Arkansas | 2-Low | 0.83 | $9,741 | $9,354 | -0.005 | -$387 | $11,461 |
| Arkansas | 3-Middle | 0.94 | $10,794 | $9,477 | -0.013 | -$1,317 | $10,258 |
| Arkansas | 4-High | 1.05 | $12,396 | $9,879 | -0.018 | -$2,518 | $9,450 |
| Arkansas | 5-Highest | 1.34 | $15,751 | $9,737 | -0.029 | -$6,014 | $7,630 |
| California | 1-Lowest | 0.72 | $8,387 | $8,833 | 0.025 | $447 | $12,855 |
| California | 2-Low | 0.97 | $11,159 | $8,899 | -0.024 | -$2,260 | $9,561 |
| California | 3-Middle | 1.14 | $13,122 | $9,084 | -0.048 | -$4,038 | $8,280 |
| California | 4-High | 1.65 | $19,459 | $10,150 | -0.087 | -$9,309 | $6,251 |
| California | 5-Highest | 2.21 | $24,548 | $9,918 | -0.092 | -$14,815 | $4,663 |
| Colorado | 1-Lowest | 0.60 | $7,017 | $8,628 | 0.028 | $1,611 | $14,620 |
| Colorado | 2-Low | 0.72 | $8,169 | $8,702 | 0.009 | $533 | $12,217 |
| Colorado | 3-Middle | 0.84 | $9,782 | $8,550 | -0.010 | -$1,232 | $10,329 |
| Colorado | 4-High | 1.16 | $13,605 | $9,582 | -0.068 | -$4,023 | $8,351 |
| Colorado | 5-Highest | 1.42 | $16,200 | $9,373 | -0.035 | -$6,827 | $6,688 |
| Connecticut | 1-Lowest | 0.53 | $6,089 | $17,504 | 0.104 | $11,416 | $34,129 |
| Connecticut | 2-Low | 0.58 | $6,783 | $17,858 | 0.085 | $11,076 | $31,607 |
| Connecticut | 3-Middle | 0.59 | $6,721 | $17,147 | 0.073 | $10,426 | $29,607 |
| Connecticut | 4-High | 0.70 | $8,033 | $17,822 | 0.037 | $9,789 | $26,311 |
| Connecticut | 5-Highest | 1.64 | $18,916 | $17,009 | -0.037 | -$1,907 | $12,683 |
| Delaware | 1-Lowest | 0.65 | $7,573 | $13,035 | 0.037 | $5,463 | $20,228 |
| Delaware | 2-Low | 0.82 | $9,782 | $13,565 | 0.022 | $3,783 | $16,886 |
| Delaware | 3-Middle | 0.96 | $11,224 | $14,657 | -0.003 | $3,433 | $15,407 |
| Delaware | 4-High | 1.00 | $11,906 | $14,907 | 0.001 | $3,002 | $15,047 |
| Delaware | 5-Highest | 0.95 | $11,141 | $13,476 | -0.001 | $2,336 | $14,295 |
| District of Columbia | 5-Highest | 3.02 | $35,340 | $18,622 | -0.058 | -$16,718 | $6,184 |
| Florida | 1-Lowest | 0.82 | $9,449 | $8,632 | 0.016 | -$817 | $10,740 |
| Florida | 2-Low | 0.90 | $10,604 | $8,806 | 0.002 | -$1,799 | $9,800 |
| Florida | 3-Middle | 1.02 | $11,856 | $8,676 | -0.004 | -$3,180 | $8,588 |
| Florida | 4-High | 1.10 | $13,100 | $8,906 | -0.011 | -$4,194 | $8,181 |
| Florida | 5-Highest | 1.16 | $13,585 | $9,096 | -0.023 | -$4,489 | $8,131 |

| State | Poverty Quintile | Cost Index Mean | Cost of National Average Outcomes | Current Spending per Pupil | Gap between Current Outcomes & National Mean (sd) | Gap between Current Spending & Cost of Avg. Outcomes | Current Spending Adjusted for Cost of Avg. Outcomes |
|---|---|---|---|---|---|---|---|
| Georgia | 1-Lowest | 0.82 | $9,626 | $8,895 | 0.032 | -$732 | $11,034 |
| Georgia | 2-Low | 1.16 | $13,745 | $9,174 | -0.011 | -$4,571 | $8,326 |
| Georgia | 3-Middle | 1.33 | $15,478 | $9,091 | -0.025 | -$6,387 | $7,098 |
| Georgia | 4-High | 1.66 | $19,421 | $9,742 | -0.042 | -$9,679 | $6,101 |
| Georgia | 5-Highest | 1.89 | $21,832 | $9,771 | -0.049 | -$12,086 | $5,408 |
| Idaho | 1-Lowest | 0.58 | $6,719 | $6,922 | 0.028 | $203 | $12,110 |
| Idaho | 2-Low | 0.66 | $7,491 | $7,008 | 0.019 | -$483 | $10,722 |
| Idaho | 3-Middle | 0.74 | $8,519 | $6,390 | 0.006 | -$2,129 | $8,658 |
| Idaho | 4-High | 0.84 | $9,892 | $6,942 | -0.002 | -$2,950 | $8,338 |
| Idaho | 5-Highest | 1.03 | $11,565 | $6,655 | -0.015 | -$4,910 | $6,493 |
| Illinois | 1-Lowest | 0.53 | $6,240 | $12,053 | 0.073 | $5,813 | $23,196 |
| Illinois | 2-Low | 0.66 | $7,729 | $12,094 | 0.043 | $4,365 | $18,781 |
| Illinois | 3-Middle | 0.81 | $9,496 | $11,801 | 0.008 | $2,305 | $14,757 |
| Illinois | 4-High | 0.92 | $10,717 | $11,073 | -0.014 | $356 | $12,302 |
| Illinois | 5-Highest | 1.74 | $20,009 | $12,228 | -0.038 | -$7,820 | $7,560 |
| Indiana | 1-Lowest | 0.51 | $6,030 | $8,437 | 0.074 | $2,408 | $16,612 |
| Indiana | 2-Low | 0.63 | $7,367 | $8,744 | 0.049 | $1,377 | $13,983 |
| Indiana | 3-Middle | 0.72 | $8,340 | $9,423 | 0.034 | $1,083 | $13,195 |
| Indiana | 4-High | 0.84 | $9,813 | $9,587 | 0.026 | -$226 | $11,609 |
| Indiana | 5-Highest | 1.38 | $16,156 | $10,587 | -0.002 | -$5,569 | $8,622 |
| Iowa | 1-Lowest | 0.54 | $6,326 | $9,667 | 0.059 | $3,341 | $18,183 |
| Iowa | 2-Low | 0.61 | $7,153 | $9,986 | 0.045 | $2,833 | $16,780 |
| Iowa | 3-Middle | 0.68 | $7,910 | $10,128 | 0.029 | $2,218 | $15,277 |
| Iowa | 4-High | 0.73 | $8,502 | $10,180 | 0.014 | $1,678 | $14,361 |
| Iowa | 5-Highest | 0.90 | $10,501 | $10,259 | -0.014 | -$242 | $11,684 |
| Kansas | 1-Lowest | 0.50 | $5,796 | $9,126 | 0.063 | $3,330 | $18,490 |
| Kansas | 2-Low | 0.63 | $7,233 | $10,003 | 0.034 | $2,769 | $16,110 |
| Kansas | 3-Middle | 0.66 | $7,619 | $9,924 | 0.031 | $2,305 | $15,241 |
| Kansas | 4-High | 0.73 | $8,521 | $10,234 | -0.001 | $1,713 | $14,151 |
| Kansas | 5-Highest | 1.02 | $11,646 | $10,560 | -0.034 | -$1,086 | $11,172 |
| Kentucky | 1-Lowest | 0.76 | $8,625 | $9,528 | 0.020 | $903 | $12,722 |
| Kentucky | 2-Low | 0.89 | $10,594 | $10,013 | 0.011 | -$582 | $11,335 |
| Kentucky | 3-Middle | 0.99 | $11,468 | $9,028 | 0.015 | -$2,440 | $9,395 |
| Kentucky | 4-High | 1.13 | $13,190 | $9,306 | 0.008 | -$3,884 | $8,494 |
| Kentucky | 5-Highest | 1.45 | $17,006 | $9,810 | -0.004 | -$7,196 | $7,205 |
| Louisiana | 1-Lowest | 0.81 | $9,390 | $10,642 | 0.002 | $1,252 | $13,257 |
| Louisiana | 2-Low | 1.04 | $12,392 | $10,518 | -0.025 | -$1,873 | $10,160 |
| Louisiana | 3-Middle | 1.15 | $13,311 | $10,795 | -0.034 | -$2,516 | $9,430 |
| Louisiana | 4-High | 1.29 | $15,173 | $10,659 | -0.047 | -$4,513 | $8,421 |
| Louisiana | 5-Highest | 1.64 | $19,115 | $11,351 | -0.057 | -$7,764 | $7,182 |
| Maine | 1-Lowest | 0.55 | $6,353 | $12,746 | 0.040 | $6,393 | $23,928 |
| Maine | 2-Low | 0.68 | $7,891 | $12,560 | 0.009 | $4,669 | $18,821 |
| Maine | 3-Middle | 0.78 | $9,186 | $12,259 | -0.002 | $3,073 | $15,898 |
| Maine | 4-High | 0.89 | $10,497 | $12,970 | -0.021 | $2,472 | $14,731 |
| Maine | 5-Highest | 1.10 | $12,826 | $12,255 | -0.010 | -$571 | $11,317 |
| Maryland | 1-Lowest | 0.70 | $8,228 | $13,671 | 0.067 | $5,444 | $20,135 |
| Maryland | 2-Low | 0.83 | $9,775 | $13,932 | 0.061 | $4,157 | $17,066 |
| Maryland | 3-Middle | 1.03 | $12,049 | $13,525 | 0.008 | $1,476 | $13,818 |
| Maryland | 4-High | 0.81 | $9,563 | $13,620 | 0.023 | $4,057 | $16,917 |
| Maryland | 5-Highest | 1.87 | $21,919 | $14,853 | -0.065 | -$7,066 | $8,889 |

| State | Poverty Quintile | Cost Index Mean | Cost of National Average Outcomes | Current Spending per Pupil | Gap between Current Outcomes & National Mean (sd) | Gap between Current Spending & Cost of Avg. Outcomes | Current Spending Adjusted for Cost of Avg. Outcomes |
|---|---|---|---|---|---|---|---|
| Massachusetts | 1-Lowest | 0.52 | $6,145 | $14,454 | 0.124 | $8,310 | $28,662 |
| Massachusetts | 2-Low | 0.57 | $6,593 | $13,811 | 0.101 | $7,218 | $25,022 |
| Massachusetts | 3-Middle | 0.64 | $7,534 | $13,914 | 0.071 | $6,381 | $22,506 |
| Massachusetts | 4-High | 0.77 | $8,944 | $15,212 | 0.052 | $6,268 | $20,202 |
| Massachusetts | 5-Highest | 1.66 | $19,319 | $15,833 | 0.003 | -$3,507 | $11,130 |
| Michigan | 1-Lowest | 0.50 | $5,803 | $9,870 | 0.053 | $4,066 | $20,205 |
| Michigan | 2-Low | 0.61 | $7,153 | $9,323 | 0.014 | $2,170 | $15,410 |
| Michigan | 3-Middle | 0.73 | $8,567 | $9,516 | -0.007 | $948 | $13,088 |
| Michigan | 4-High | 0.89 | $10,366 | $9,621 | -0.026 | -$745 | $11,021 |
| Michigan | 5-Highest | 1.71 | $19,644 | $11,275 | -0.071 | -$8,733 | $7,691 |
| Minnesota | 1-Lowest | 0.54 | $6,303 | $9,937 | 0.077 | $3,634 | $18,681 |
| Minnesota | 2-Low | 0.64 | $7,418 | $10,327 | 0.049 | $2,909 | $16,391 |
| Minnesota | 3-Middle | 0.70 | $8,227 | $10,772 | 0.042 | $2,545 | $15,505 |
| Minnesota | 4-High | 0.77 | $9,021 | $10,706 | 0.025 | $1,685 | $13,962 |
| Minnesota | 5-Highest | 1.20 | $13,987 | $12,754 | -0.012 | -$1,233 | $11,132 |
| Mississippi | 1-Lowest | 0.76 | $8,877 | $7,711 | 0.004 | -$1,166 | $10,365 |
| Mississippi | 2-Low | 1.03 | $12,152 | $8,358 | -0.020 | -$3,793 | $8,169 |
| Mississippi | 3-Middle | 1.26 | $14,635 | $8,295 | -0.043 | -$6,340 | $6,623 |
| Mississippi | 4-High | 1.66 | $19,487 | $8,546 | -0.066 | -$10,941 | $5,258 |
| Mississippi | 5-Highest | 2.28 | $26,035 | $9,043 | -0.085 | -$17,010 | $4,098 |
| Missouri | 1-Lowest | 0.56 | $6,590 | $9,777 | 0.040 | $3,187 | $17,943 |
| Missouri | 2-Low | 0.70 | $8,174 | $9,312 | 0.008 | $1,138 | $13,624 |
| Missouri | 3-Middle | 0.80 | $9,420 | $8,961 | -0.006 | -$459 | $11,385 |
| Missouri | 4-High | 0.90 | $10,441 | $8,932 | -0.007 | -$1,509 | $10,172 |
| Missouri | 5-Highest | 1.46 | $16,982 | $9,739 | -0.038 | -$7,243 | $7,206 |
| Montana | 1-Lowest | 0.63 | $6,860 | $9,272 | 0.048 | $2,413 | $15,140 |
| Montana | 2-Low | 0.61 | $6,625 | $9,183 | 0.040 | $2,558 | $15,318 |
| Montana | 3-Middle | 0.71 | $7,711 | $9,034 | 0.028 | $1,324 | $12,813 |
| Montana | 4-High | 0.81 | $8,778 | $9,365 | 0.034 | $587 | $11,769 |
| Montana | 5-Highest | 1.35 | $14,665 | $12,563 | -0.076 | -$2,103 | $9,583 |
| Nebraska | 1-Lowest | 0.50 | $5,947 | $10,307 | 0.057 | $4,360 | $20,523 |
| Nebraska | 2-Low | 0.61 | $7,068 | $11,600 | 0.030 | $4,532 | $19,249 |
| Nebraska | 3-Middle | 0.66 | $7,593 | $11,077 | 0.033 | $3,484 | $16,847 |
| Nebraska | 4-High | 0.69 | $8,146 | $11,130 | 0.027 | $2,984 | $16,257 |
| Nebraska | 5-Highest | 0.89 | $10,462 | $11,848 | -0.028 | $1,386 | $13,590 |
| Nevada | 1-Lowest | 0.78 | $8,464 | $10,186 | -0.029 | $1,721 | $12,919 |
| Nevada | 2-Low | 0.79 | $8,599 | $9,691 | 0.003 | $1,092 | $12,329 |
| Nevada | 3-Middle | 0.90 | $9,808 | $8,608 | 0.007 | -$1,201 | $9,536 |
| Nevada | 4-High | 0.92 | $10,064 | $10,084 | -0.002 | $20 | $10,999 |
| Nevada | 5-Highest | 1.31 | $14,287 | $8,085 | -0.013 | -$6,202 | $6,159 |
| New Hampshire | 1-Lowest | 0.49 | $5,685 | $13,954 | 0.080 | $8,268 | $31,804 |
| New Hampshire | 2-Low | 0.55 | $6,446 | $13,702 | 0.057 | $7,256 | $26,356 |
| New Hampshire | 3-Middle | 0.64 | $7,425 | $14,093 | 0.048 | $6,668 | $22,763 |
| New Hampshire | 4-High | 0.72 | $8,483 | $15,308 | 0.043 | $6,824 | $21,639 |
| New Hampshire | 5-Highest | 0.92 | $10,654 | $14,691 | 0.011 | $4,036 | $16,516 |
| New Jersey | 1-Lowest | 0.51 | $5,818 | $16,238 | 0.116 | $10,419 | $32,393 |
| New Jersey | 2-Low | 0.60 | $6,938 | $16,412 | 0.092 | $9,474 | $28,310 |
| New Jersey | 3-Middle | 0.71 | $8,158 | $16,048 | 0.067 | $7,890 | $23,297 |
| New Jersey | 4-High | 0.96 | $11,069 | $16,018 | 0.029 | $4,949 | $17,232 |
| New Jersey | 5-Highest | 2.50 | $28,065 | $18,838 | -0.025 | -$9,834 | $8,791 |

| State | Poverty Quintile | Cost Index Mean | Cost of National Average Outcomes | Current Spending per Pupil | Gap between Current Outcomes & National Mean (sd) | Gap between Current Spending & Cost of Avg. Outcomes | Current Spending Adjusted for Cost of Avg. Outcomes |
|---|---|---|---|---|---|---|---|
| New Mexico | 1-Lowest | 0.87 | $10,099 | $8,882 | -0.026 | -$1,217 | $10,553 |
| New Mexico | 2-Low | 1.02 | $11,880 | $8,851 | -0.036 | -$3,029 | $8,776 |
| New Mexico | 3-Middle | 1.16 | $13,374 | $9,190 | -0.039 | -$4,184 | $7,985 |
| New Mexico | 4-High | 1.36 | $15,903 | $9,953 | -0.044 | -$5,950 | $7,414 |
| New Mexico | 5-Highest | 1.90 | $22,130 | $10,430 | -0.061 | -$11,701 | $5,685 |
| New York | 1-Lowest | 0.55 | $6,171 | $21,464 | 0.053 | $15,292 | $39,637 |
| New York | 2-Low | 0.61 | $6,932 | $19,379 | 0.017 | $12,447 | $31,941 |
| New York | 3-Middle | 0.79 | $8,986 | $18,988 | -0.021 | $10,002 | $24,662 |
| New York | 4-High | 1.02 | $11,677 | $19,161 | -0.050 | $7,483 | $19,627 |
| New York | 5-Highest | 2.06 | $23,548 | $20,248 | -0.044 | -$3,300 | $10,311 |
| North Carolina | 1-Lowest | 0.74 | $8,659 | $8,232 | 0.042 | -$427 | $11,300 |
| North Carolina | 2-Low | 0.87 | $10,126 | $8,581 | 0.012 | -$1,545 | $10,004 |
| North Carolina | 3-Middle | 0.95 | $11,011 | $8,554 | 0.007 | -$2,457 | $9,160 |
| North Carolina | 4-High | 1.04 | $12,139 | $8,926 | -0.008 | -$3,213 | $8,737 |
| North Carolina | 5-Highest | 1.36 | $16,011 | $9,074 | -0.027 | -$6,936 | $6,869 |
| North Dakota | 1-Lowest | 0.64 | $7,640 | $11,125 | 0.039 | $3,485 | $17,407 |
| North Dakota | 2-Low | 0.66 | $7,769 | $11,219 | 0.055 | $3,450 | $17,235 |
| North Dakota | 3-Middle | 0.72 | $8,251 | $11,294 | 0.033 | $3,043 | $15,894 |
| North Dakota | 4-High | 0.85 | $9,766 | $12,413 | 0.022 | $2,648 | $15,349 |
| North Dakota | 5-Highest | 1.51 | $17,625 | $13,659 | -0.031 | -$3,966 | $10,351 |
| Ohio | 1-Lowest | 0.51 | $5,937 | $10,335 | 0.080 | $4,398 | $20,680 |
| Ohio | 2-Low | 0.62 | $7,191 | $9,578 | 0.049 | $2,388 | $15,758 |
| Ohio | 3-Middle | 0.69 | $8,095 | $9,640 | 0.034 | $1,545 | $14,039 |
| Ohio | 4-High | 0.83 | $9,640 | $9,798 | 0.018 | $158 | $12,035 |
| Ohio | 5-Highest | 1.52 | $17,798 | $11,374 | -0.039 | -$6,424 | $8,053 |
| Oklahoma | 1-Lowest | 0.59 | $6,936 | $7,228 | 0.026 | $299 | $12,357 |
| Oklahoma | 2-Low | 0.75 | $8,810 | $7,789 | 0.003 | -$1,020 | $10,478 |
| Oklahoma | 3-Middle | 0.87 | $10,201 | $7,809 | -0.008 | -$2,393 | $9,003 |
| Oklahoma | 4-High | 1.03 | $12,087 | $8,175 | -0.027 | -$3,913 | $8,014 |
| Oklahoma | 5-Highest | 1.30 | $15,130 | $8,476 | -0.056 | -$6,654 | $6,624 |
| Oregon | 1-Lowest | 0.64 | $7,485 | $8,897 | 0.013 | $1,412 | $13,905 |
| Oregon | 2-Low | 0.77 | $9,062 | $9,535 | -0.012 | $472 | $12,376 |
| Oregon | 3-Middle | 0.88 | $10,448 | $9,334 | -0.035 | -$1,113 | $10,598 |
| Oregon | 4-High | 1.03 | $11,868 | $9,238 | -0.029 | -$2,631 | $9,045 |
| Oregon | 5-Highest | 1.39 | $16,061 | $9,916 | -0.056 | -$6,145 | $7,371 |
| Pennsylvania | 1-Lowest | 0.52 | $6,140 | $13,617 | 0.087 | $7,476 | $26,162 |
| Pennsylvania | 2-Low | 0.61 | $7,123 | $12,430 | 0.052 | $5,307 | $20,681 |
| Pennsylvania | 3-Middle | 0.72 | $8,355 | $12,522 | 0.033 | $4,167 | $17,664 |
| Pennsylvania | 4-High | 0.83 | $9,789 | $12,689 | 0.018 | $2,901 | $15,536 |
| Pennsylvania | 5-Highest | 1.73 | $20,304 | $12,226 | -0.039 | -$8,085 | $8,718 |
| Rhode Island | 1-Lowest | 0.51 | $5,825 | $14,450 | 0.078 | $8,626 | $29,478 |
| Rhode Island | 2-Low | 0.60 | $7,079 | $14,900 | 0.049 | $7,821 | $24,770 |
| Rhode Island | 3-Middle | 0.69 | $8,039 | $15,211 | 0.033 | $7,172 | $22,602 |
| Rhode Island | 4-High | 0.82 | $9,576 | $14,292 | 0.008 | $4,716 | $17,679 |
| Rhode Island | 5-Highest | 1.83 | $21,374 | $14,298 | -0.067 | -$7,076 | $9,583 |
| South Carolina | 1-Lowest | 0.77 | $9,070 | $9,200 | 0.012 | $130 | $12,239 |
| South Carolina | 2-Low | 0.99 | $11,559 | $9,589 | -0.008 | -$1,971 | $9,809 |
| South Carolina | 3-Middle | 1.08 | $12,622 | $9,980 | -0.018 | -$2,642 | $9,294 |
| South Carolina | 4-High | 1.28 | $14,946 | $10,060 | -0.042 | -$4,886 | $7,923 |
| South Carolina | 5-Highest | 1.54 | $17,742 | $10,177 | -0.066 | -$7,565 | $6,697 |

| State | Poverty Quintile | Cost Index Mean | Cost of National Average Outcomes | Current Spending per Pupil | Gap between Current Outcomes & National Mean (sd) | Gap between Current Spending & Cost of Avg. Outcomes | Current Spending Adjusted for Cost of Avg. Outcomes |
|---|---|---|---|---|---|---|---|
| South Dakota | 1-Lowest | 0.56 | $6,475 | $7,921 | 0.028 | $1,446 | $14,331 |
| South Dakota | 2-Low | 0.61 | $7,041 | $8,062 | 0.027 | $1,021 | $13,461 |
| South Dakota | 3-Middle | 0.65 | $7,497 | $8,165 | 0.020 | $668 | $12,594 |
| South Dakota | 4-High | 0.76 | $8,738 | $8,590 | -0.002 | -$147 | $11,344 |
| South Dakota | 5-Highest | 1.41 | $16,282 | $11,163 | -0.065 | -$5,120 | $8,810 |
| Tennessee | 1-Lowest | 0.70 | $8,216 | $8,168 | 0.024 | -$48 | $11,980 |
| Tennessee | 2-Low | 0.79 | $9,271 | $8,317 | 0.005 | -$954 | $10,709 |
| Tennessee | 3-Middle | 0.92 | $10,986 | $8,884 | -0.007 | -$2,102 | $9,766 |
| Tennessee | 4-High | 1.00 | $11,674 | $8,734 | -0.021 | -$2,940 | $8,868 |
| Tennessee | 5-Highest | 1.01 | $11,673 | $8,096 | -0.016 | -$3,577 | $8,190 |
| Texas | 1-Lowest | 0.72 | $8,400 | $8,052 | 0.024 | -$348 | $11,496 |
| Texas | 2-Low | 0.87 | $10,153 | $8,343 | -0.013 | -$1,810 | $9,842 |
| Texas | 3-Middle | 1.07 | $12,437 | $8,530 | -0.033 | -$3,907 | $8,205 |
| Texas | 4-High | 1.22 | $14,362 | $8,747 | -0.040 | -$5,615 | $7,465 |
| Texas | 5-Highest | 1.85 | $21,578 | $8,896 | -0.058 | -$12,682 | $5,216 |
| Utah | 1-Lowest | 0.56 | $6,508 | $6,027 | 0.032 | -$482 | $10,892 |
| Utah | 2-Low | 0.63 | $7,516 | $6,135 | 0.022 | -$1,381 | $9,763 |
| Utah | 3-Middle | 0.74 | $8,870 | $6,888 | -0.019 | -$1,982 | $9,365 |
| Utah | 4-High | 0.81 | $9,408 | $6,893 | -0.002 | -$2,516 | $8,533 |
| Utah | 5-Highest | 0.99 | $11,533 | $7,780 | 0.000 | -$3,753 | $7,914 |
| Vermont | 1-Lowest | 0.53 | $6,125 | $13,983 | 0.082 | $7,859 | $30,127 |
| Vermont | 2-Low | 0.66 | $7,551 | $14,838 | 0.057 | $7,288 | $26,947 |
| Vermont | 3-Middle | 0.82 | $9,263 | $15,474 | 0.038 | $6,210 | $21,743 |
| Vermont | 4-High | 0.95 | $10,947 | $15,807 | 0.027 | $4,859 | $18,399 |
| Vermont | 5-Highest | 1.29 | $14,936 | $15,798 | -0.011 | $862 | $14,750 |
| Virginia | 1-Lowest | 0.76 | $8,867 | $11,495 | 0.024 | $2,629 | $15,455 |
| Virginia | 2-Low | 0.78 | $9,267 | $10,395 | 0.005 | $1,129 | $13,694 |
| Virginia | 3-Middle | 0.96 | $11,201 | $10,520 | -0.010 | -$680 | $11,198 |
| Virginia | 4-High | 1.06 | $12,637 | $10,245 | -0.016 | -$2,392 | $9,847 |
| Virginia | 5-Highest | 1.50 | $17,384 | $10,762 | -0.040 | -$6,623 | $7,665 |
| Washington | 1-Lowest | 0.67 | $7,278 | $9,125 | 0.069 | $1,848 | $13,814 |
| Washington | 2-Low | 0.90 | $9,774 | $9,650 | 0.041 | -$124 | $10,835 |
| Washington | 3-Middle | 1.06 | $11,534 | $9,395 | 0.016 | -$2,139 | $9,118 |
| Washington | 4-High | 1.23 | $13,345 | $9,781 | 0.002 | -$3,563 | $8,166 |
| Washington | 5-Highest | 1.91 | $19,808 | $10,257 | -0.031 | -$10,516 | $5,765 |
| West Virginia | 1-Lowest | 0.77 | $8,844 | $11,034 | 0.000 | $2,190 | $14,575 |
| West Virginia | 2-Low | 0.85 | $9,862 | $11,266 | -0.016 | $1,404 | $13,371 |
| West Virginia | 3-Middle | 0.90 | $10,675 | $10,970 | -0.023 | $296 | $12,294 |
| West Virginia | 4-High | 0.97 | $11,340 | $11,250 | -0.033 | -$90 | $11,677 |
| West Virginia | 5-Highest | 1.19 | $13,815 | $11,162 | -0.038 | -$2,653 | $9,591 |
| Wisconsin | 1-Lowest | 0.53 | $6,172 | $10,437 | 0.070 | $4,265 | $20,086 |
| Wisconsin | 2-Low | 0.62 | $7,217 | $10,704 | 0.044 | $3,487 | $17,367 |
| Wisconsin | 3-Middle | 0.72 | $8,441 | $10,978 | 0.030 | $2,537 | $15,334 |
| Wisconsin | 4-High | 0.86 | $9,903 | $11,363 | 0.018 | $1,460 | $13,313 |
| Wisconsin | 5-Highest | 1.44 | $16,908 | $12,012 | -0.032 | -$4,896 | $9,441 |
| Wyoming | 1-Lowest | 0.68 | $7,734 | $15,950 | 0.008 | $8,216 | $23,573 |
| Wyoming | 2-Low | 0.73 | $8,546 | $16,452 | 0.037 | $7,906 | $22,772 |
| Wyoming | 3-Middle | 0.78 | $9,232 | $15,264 | 0.031 | $6,032 | $19,549 |
| Wyoming | 4-High | 0.81 | $9,374 | $15,643 | 0.023 | $6,268 | $19,555 |
| Wyoming | 5-Highest | 1.04 | $12,235 | $17,122 | 0.030 | $4,887 | $16,936 |

## Appendix D

# First Stage Regression Estimates

First-stage regression of outcome_index:

OLS estimation

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity and clustering on leaid

Number of clusters (leaid) = 11636 — Number of obs = 80670
F( 32, 11635) = 447.81
Prob > F = 0.0000
Total (centered) SS = 267.6798718 — Centered R2 = 0.4861
Total (uncentered) SS = 2441388.609 — Uncentered R2 = 0.9999
Residual SS = 137.5643909 — Root MSE = .0413

| outcome_index | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| adj_pov | -.1796095 | .0163119 | -11.01 | 0.000 | -.2115836 | -.1476353 |
| pov_x_density | -.0288614 | .0029275 | -9.86 | 0.000 | -.0345998 | -.023123 |
| ecwi_cwi | -.0334949 | .0036786 | -9.11 | 0.000 | -.0407055 | -.0262842 |
| pctpk_ccdpsu | .0334415 | .0133558 | 2.50 | 0.012 | .0072619 | .0596212 |
| pctk_ccdpsu | -.0980999 | .0217166 | -4.52 | 0.000 | -.140668 | -.0555318 |
| pct6to8_ccdpsu | .1883818 | .012674 | 14.86 | 0.000 | .1635386 | .213225 |
| pct9to12_ccdpsu | .0772886 | .0070527 | 10.96 | 0.000 | .0634641 | .091113 |
| enroll_under100 | .0394077 | .0301754 | 1.31 | 0.192 | -.0197412 | .0985566 |
| enroll_101to300 | .0106354 | .0051571 | 2.06 | 0.039 | .0005267 | .0207442 |
| enroll_301to600 | .0055867 | .0033507 | 1.67 | 0.095 | -.0009812 | .0121545 |
| enroll_601to1200 | .0025686 | .0029494 | 0.87 | 0.384 | -.0032126 | .0083499 |
| enroll_1201to1500 | -.0010069 | .0037369 | -0.27 | 0.788 | -.0083318 | .0063181 |
| enroll_1501to2000 | -.0068816 | .0035417 | -1.94 | 0.052 | -.0138239 | .0000608 |
| ln_density | .010153 | .0006946 | 14.62 | 0.000 | .0087915 | .0115145 |
| enroll_under100_x_density | -.00486 | .0074565 | -0.65 | 0.515 | -.019476 | .0097561 |
| enroll_101to300_x_density | -.0024539 | .0011825 | -2.08 | 0.038 | -.0047718 | -.000136 |
| enroll_301to600_x_density | -.0013635 | .0006907 | -1.97 | 0.048 | -.0027173 | -9.69e-06 |
| enroll_601to1200_x_density | -.0002428 | .0005559 | -0.44 | 0.662 | -.0013323 | .0008468 |
| enroll_1201to1500_x_density | .0005798 | .0007071 | 0.82 | 0.412 | -.0008063 | .0019659 |
| enroll_1501to2000_x_density | .001543 | .0006529 | 2.36 | 0.018 | .0002633 | .0028227 |
| k12 | -.0120858 | .0019725 | -6.13 | 0.000 | -.0159523 | -.0082193 |
| aid_ratio | -.0359801 | .0025302 | -14.22 | 0.000 | -.0409398 | -.0310204 |
| hhi_enroll | .002831 | .0028218 | 1.00 | 0.316 | -.0027003 | .0083623 |
| pct_5to17 | .0405865 | .0131525 | 3.09 | 0.002 | .0148055 | .0663676 |
| _Iyear_2010 | .0078477 | .0002808 | 27.95 | 0.000 | .0072972 | .0083981 |
| _Iyear_2011 | .0120573 | .0003421 | 35.24 | 0.000 | .0113867 | .0127279 |
| _Iyear_2012 | .0132866 | .0003962 | 33.54 | 0.000 | .01251 | .0140632 |
| _Iyear_2013 | .0150301 | .0004651 | 32.32 | 0.000 | .0141184 | .0159417 |
| _Iyear_2014 | .009074 | .000542 | 16.74 | 0.000 | .0080116 | .0101364 |
| _Iyear_2015 | .0090016 | .0007572 | 11.89 | 0.000 | .0075174 | .0104858 |
| ln_nei_mhi | .0215719 | .0035737 | 6.04 | 0.000 | .0145669 | .0285769 |
| ln_nei_mhu | -.0022885 | .0020723 | -1.10 | 0.269 | -.0063505 | .0017735 |
| _cons | 5.351643 | .0306591 | 174.55 | 0.000 | 5.291546 | 5.41174 |

Included instruments: adj_pov pov_x_density ecwi_cwi pctpk_ccdpsu pctk_ccdpsu
pct6to8_ccdpsu pct9to12_ccdpsu enroll_under100
enroll_101to300 enroll_301to600 enroll_601to1200
enroll_1201to1500 enroll_1501to2000 ln_density
enroll_under100_x_density enroll_101to300_x_density
enroll_301to600_x_density enroll_601to1200_x_density
enroll_1201to1500_x_density enroll_1501to2000_x_density
k12 aid_ratio hhi_enroll pct_5to17 _Iyear_2010 _Iyear_2011
_Iyear_2012 _Iyear_2013 _Iyear_2014 _Iyear_2015 ln_nei_mhi
ln_nei_mhu

Partial R-squared of excluded instruments: 0.0046
Test of excluded instruments:
F( 2, 11635) = 27.83
Prob > F = 0.0000

## End Notes

[1] See, for example Baker, B. D. (2016). Does money matter in education?. *Albert Shanker Institute*.

[2] Baker, B. D., & Weber, M. (2016). Deconstructing the Myth of American Public Schooling Inefficiency.

[3] Baker, B. D., Farrie, D., & Sciarra, D. G. (2016). Mind the Gap: 20 Years of Progress and Retrenchment in School Funding and Achievement Gaps. *ETS Research Report Series*, *2016*(1), 1-37.

[4] Baker, B. D., Sciarra, D. G., & Farrie, D. (2010). Is School Funding Fair? A National Report Card. *Education Law Center*.

[5] See: Ahn, J., & McEachin, A. (2017). Student Enrollment Patterns and Achievement in Ohio's Online Charter Schools. *Educational Researcher*, *46*(1), 44–57.

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*Gannon v. State*, 368 P.3d 1024, 303 Kan. 682 (2016).

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[25] *Fiscal Equity v. State of NY*, 801 N.E.2d 326, 100 N.Y.2d 893, 769 N.Y.S.2d 106 (2003).

As we further explained, many of the more detailed standards established by the Board of Regents and Commissioner of Education "exceed notions of a minimally adequate or sound basic education," so that proof that schools do not comply with such standards "may not, standing alone, establish a violation of the Education Article" (*id.*). The trial court, accordingly, declined to fix the most recent, and ambitious, statement of educational goals—the Regents Learning Standards, adopted in 1996—as the definition of a sound basic education (187 Misc 2d at 12). As the trial court observed, so to enshrine the Learning Standards would be to cede to a state agency the power to define a constitutional right.

[26] Rebell, M. A. (2011). Safeguarding the right to a sound basic education in times of fiscal constraint. *Alb. L. Rev.*, *75*, 1855.

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[32] See: Baker, B.D., Welner, K. (2011) School Finance and Courts: Does Reform Matter, and How Can We Tell? Teachers College Record 113 (11)

[33]Hanushek, E. (2005, October). *The alchemy of 'costing out' and adequate education*. Paper presented at the Adequacy Lawsuits: Their Growing Impact on American Education conference, Cambridge, MA. Costrell, R., Hanushek, E., & Loeb, S. (2008). What do cost functions tell us about the cost of an adequate education? *Peabody Journal of Education*, *83*, 198–223.

[34] For elaboration on this argument, see: Costrell, R., Hanushek, E., & Loeb, S. (2008). What do cost functions tell us about the cost of an adequate education? Peabody Journal of Education, 83, 198–223.

[35] An alternative version of this argument is presented by the "efficiency" intervenors in *Fort Bend ISD v. Scott*, a Texas school funding case. Intervenors' brief explains: "Therefore, it is literally impossible for the legislature or other current managers of the school system in Texas to take the position, in cost-effective economic terms, that any particular level of funding is necessary for efficiency. Even the question of allocation of funding among districts cannot be determined in an efficient manner without a more substantive and comprehensive system of financial accountability." https://www.tasb.org/Legislative/Issue-Based-Resources/School-Finance/documents/treeintervention.aspx (p. 9) This comment would appear to be a backhanded attempt to undermine any use of analysis of existing spending data for addressing either the overall adequacy of funding to Texas school districts or the equitable distribution of that funding. But this argument suffers the same lack of substantiation that there actually exists some hypothetically more efficient system out there somewhere, and that the current system is necessarily so inefficient as to be irrelevant. The only reasonable basis for the court to determine education costs in Texas, and how they vary across children and settings, is to evaluate those costs in the context of policies as they currently exist, given the actual production of outcomes and average efficiency of schools and districts in producing those outcomes. Reducing regulations may be a rational alternative, and re-estimating costs after such policy change is also reasonable. If costs of desired outcomes go down after such policy change, then great! But one cannot simply assume that regulatory change (or charter expansion as an approach to regulatory reduction – see Section 5.0) will result in dramatic efficiency gains.

[36] In fact, the logical way to test these very assertions would be to permit or encourage some schools/districts to experiment with alternative compensation strategies, and other "reforms," and to include these schools and districts among those employing other strategies (production technologies) in a cost function model, and see where they land along the curve. That is, do schools/districts that adopt these strategies land in a different location along the curve? Do they get the same outcomes with the same kids at much lower spending?

[37] Duncombe, W., & Johnston, J. (2004). The impacts of school finance reform in Kansas: Equity is in the eye of the beholder. In J. Yinger (Ed.), Helping children left behind: State aid and the pursuit of educational equity (pp. 147–193). Cambridge, MA: MIT Press.

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[38] See: https://cepa.stanford.edu/sites/default/files/wp16-09-v201706.pdf

[39] Our instruments pass traditional tests of relevance (that they predict variation in endogenous "outcome" measure, as evidenced by the partial F-statistic), exogenous (they do not substantially predict our spending measure), and pass the test for over-identification (as evidenced by the Hansen J p-value).

[40] Baker, B. D. (2011). Exploring the sensitivity of education costs to racial composition of schools and race-neutral alternative measures: A cost function application to Missouri. *Peabody Journal of Education*, *86*(1), 58-83.

[41] Baker, B. D. (2003). State policy influences on the internal allocation of school district resources: Evidence from the common core of data. *Journal of Education Finance*, *29*(1), 1-24.

[42] For these years, outcome data were more complete in the Stanford Education Data Archive.

[43] See, for example: http://trib.com/news/local/education/wyoming-s-public-school-funding-crisis-years-in-the-making/article_c132469d-735b-58d3-86a4-58aad405c0e9.html

[44] See, for example: Weber, M. A. & Srikanth, A. (2017). How Fair is the "Fairness Formula" for New Jersey School Children & Taxpayers? NJ Education Policy Forum. Retrieved from: https://njedpolicy.wordpress.com/2016/06/30/how-fair-is-the-fairness-formula-for-new-jersey-school-children-taxpayers/

[45] Leachman, M., Albares, N., Masterson, K., & Wallace, M. (2016). Most states have cut school funding, and some continue cutting. *Center on Budget and Policy Priorities*, 4.

[46] Baker, B. D. (2014). America's Most Financially Disadvantaged School Districts and How They Got That Way: How State and Local Governance Causes School Funding Disparities. *Center for American Progress*.

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